Draft Programmatic Environmental Impact Statement Veterinary Services

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Abstract

Veterinary Services (VS) is the Federal agency responsible for the prevention, surveillance, control, and eradication of foreign and endemic animal diseases. Within this Programmatic Environmental Impact Statement (EIS), these elements of the VS program were examined in an effort to identify and further scrutinize those activities that have the potential to affect the human environment.

Other background information also was included to provide the reader with a better appreciation of the role of the VS program. Some of this information is historical in nature, such as a listing of those animal diseases that have been eradicated from the United States.

This EIS does not propose and evaluate a myriad of possible program alternatives. Rather it considers only two basic alternatives: the current program as designed and the "no Federal action" alternative. The no action alternative is assumed to be the lack of any Federal activity in the prevention, surveillance, control, and eradication of foreign and endemic animal diseases. In this case, these activities would be performed entirely by individual States, industry, and other groups.

Within the current program the level of Federal participation will vary on a program-specific basis. Within each program element, specific activities were identified as having potential environmental impacts. These activities included carcass disposal, the use of pesticides and disinfectants, some aspects of import/export activities, animal vaccination, facilities, and animal identification. These activities were discussed at length along with those additional actions currently being taken to mitigate environmental damage.

This document is intended to provide baseline information to be used for environmental assessments (EA) that may be required for site-specific actions, such as a campaign to eradicate a specific animal disease within a discrete geographical location. With this in mind, a checklist also was developed as part of this EIS to facilitate the completion of EAs by either headquarters or field personnel.

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Summary

The Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) is responsible for protecting the country's agriculture. Veterinary Services (VS) is responsible for the protection of the Nation's livestock and poultry. As part of this mission, VS is conducting ongoing programs designed to detect, prevent, control, and eradicate domestic and foreign animal diseases and pests that threaten these resources.

This Environmental Impact Statement (EIS) is programmatic in nature. It addresses ongoing VS programs and activities that have the potential to impact the quality of the human environment, which includes "the natural and physical environment and the relationship of people with that environment" (40 CFR § 1508.4). The scope and areas of emphasis in this EIS were determined through public scoping and APHIS internal review.

No proposal, as defined in the Council on Environmental Quality (CEQ) implementing regulations for the National Environmental Policy Act, is included in this EIS (40 CFR § 1500-1508). The CEQ regulations define a proposal as existing "at that stage in development of an action when an agency subject to the Act has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated" (40 CFR § 1508.23). Instead, this EIS examines the potential impacts of the entire VS program as currently implemented, plus the no Federal action alternative as required by CEQ regulations (40 CFR § 1502.14). Agencies may prepare an EIS or environmental assessment on any action "in order to assist agency planning and decisionmaking" (40 CFR § 1501.3).

The following VS programs and activities have been identified as having the potential to affect the quality of the human environment.

- **Methods of animal carcass disposal.** Methods used to dispose of animal carcasses include burning, incineration, burial, rendering, composting, and fermentation. The potential environmental consequences posed by each of these methods is discussed. In keeping with the programmatic nature of this EIS, no method is identified as a preferred alternative. The method that would pose minimal potential harm to the environment would be dependent upon certain site-specific resource and environmental criteria and other factors that are identified in Environmental Checklists for Carcass Disposal in Chapter IV.

Emerging or improved technologies that may be applicable to carcass disposal are discussed in the introduction of Chapter I.

- **Disease eradication efforts of an emergency nature**. As opposed to ongoing activities, actions arising out of response to an emergency situation require rapid planning and implementation. These actions include imposition of quarantines, depopulation, disposal of animals, and the cleaning and disinfection of infected premises. The Environmental Checklist for Carcass Disposal was developed in part to facilitate the planning and implementation of an emergency disease eradication campaign to ensure environmental concerns are considered and integrated into the campaign.

- **Use of pesticides and disinfectants**. Pesticides are used to control insects that are potential disease vectors. Disinfectants are used to prevent reinfection from contamination. The method of application of pesticides and disinfectants is similar whether the situation is routine or emergency in nature. The goal of VS is to use pesticides and disinfectants only when needed and apply them safely according to label instructions.

- **The import-export program**. This program seeks to protect American livestock and poultry against the introduction and dissemination of foreign animal diseases and pests. The health of animals and safety of animal products being imported or exported into and out of the United States is protected through inspection and certification programs.

- **The vaccination program**. This program utilizes vaccines to help eradicate and control some animal diseases. Disease monitoring, surveillance, eradication technologies, and regulatory mechanisms are used in conjunction with the use of vaccines.

- **The construction, use, and expansion of facilities**. Laboratories, animal import centers, and border facilities throughout the United States are operated by VS. These facilities enable VS to conduct animal disease detection and diagnostic work, biologics testing, animal disease research, animal quarantine activities, and animal disease treatments.

- **Methods of animal identification**. VS uses methods, such as branding and ear tagging, to identify positive reactor animals in certain disease programs and to track animal diseases where animal outbreaks occur.

I. Introduction

A. Purpose and Need

This programmatic environmental impact statement (EIS) covers ongoing U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS) programs and activities. The purpose of this EIS is to:

- Provide a broad environmental overview of program elements and issues.
- Inform and involve the public in the environmental decisionmaking process.
- Integrate the National Environmental Policy Act (NEPA) process into VS program planning and decisionmaking procedures.
- Allow the preparation of a subsequent site-specific environmental assessment (EA) or environmental impact statement (EIS) which could be tiered to this programmatic EIS.
- Provide decisionmakers with flexible guidance, alternative approaches, and mitigation strategies regarding environmental impacts of VS programs for environmental decisionmaking at the site-specific level.
- Provide guidelines for emergency disease eradication and carcass disposal to minimize environmental impacts.

The underlying need for the various ongoing VS programs and activities is to protect American livestock and poultry from diseases and pests. Over 100 diseases and pests can be spread from animals to humans and even more can be spread from livestock and poultry to wildlife. Therefore, these efforts protect human health, the multibillion dollar livestock and poultry industry, wildlife, and help ensure high quality of imports and U.S. exports. The Federal VS programs and activities complement State programs. They provide interstate coordination, development and dissemination of information, and uniformity and rapid response to disease and pest control and eradication efforts.

B. Background

The first Congressional action taken to prevent disease introductions into the United States was in 1865. It established cattle quarantine stations. These stations were originally administered by the Treasury Department but were later transferred to USDA. This transfer was followed in 1883 by the establishment of the Veterinary Division within USDA to study animal diseases. The Veterinary Division became the Bureau of Animal Industry (BAI) with the passage of the Act of May 29, 1884 (21 U.S.C. §391). BAI's first responsibilities were to eradicate pleuropneumonia and other diseases found among domestic livestock and to prevent the export of diseased cattle. The eradication of pleuropneumonia was accomplished in 1892, and since that time 12 other major animal diseases have been eradicated from the United States (see Table 1).

BAI was the predecessor of many Federal agencies including APHIS VS. BAI's responsibilities expanded over the years to include activities such as meat and poultry inspection, animal welfare, food safety, and research. Today these responsibilities are dispersed among several agencies within USDA and the Department of Health and Human Service (DHHS) that cooperate with each other.

The primary tasks of APHIS VS are: (1) keeping foreign animal diseases (FAD) and pests out of the United States, (2) eradicating outbreaks of FADs and pests should they get into the United States, (3) eradicating domestic diseases and pests of economic and/or human health significance, and (4) preventing the interstate spread of animal diseases and pests (Wiser, *et al.*, 1987).

VS carries out national programs to protect the health of U.S. livestock and poultry resources, monitors animal imports and exports, prevents the entry of exotic diseases and pests, and participates and cooperates with States and industry in disease control and eradication programs. These functions are achieved by providing resources, direction, and technical assistance. Protection of livestock and poultry from diseases and pests is accomplished through four major VS programs and activities: prevention, surveillance, control, and eradication. These programs and activities are coordinated with State and local authorities.

- Prevention activities are designed to exclude the entry of FADs and pests into the United States and to prevent the interstate spread of endemic animal diseases and pests. Such activities include observations, inspections, testing, permitting, reviewing health certificates, treatments, and quarantines.

- Surveillance includes the detection of domestic animal diseases and FADs worldwide. Statistical sampling of livestock and poultry is done to determine the distribution and trends of certain diseases and how they affect marketability. Also included is monitoring of livestock and poultry health through specimen collection.

- Control activities may be used by VS to reduce the spread of disease, once the animals have become infected. They are applied when eradication is not feasible and can include inspections, testing, vaccinations, treatments, and quarantines.

- Eradication programs include those activities necessary to eliminate an animal disease or pest. Such activities can include inspections, testing, quarantines, depopulation with carcass disposal, cleaning and disinfecting of premises and transport vehicles, and vector control. The VS regional emergency animal disease eradication organizations (READEO) may participate in the activities associated with emergency eradication programs. READEOs are teams of preselected, pertinent animal health specialists that are deployed once an animal disease emergency is recognized.

Within USDA, APHIS has three units that work together to protect U.S. livestock and poultry. VS has the responsibility for disease prevention and control; Veterinary Biologics in Biotechnology, Biologics, and Environmental Protection assures that veterinary biologics are safe, efficacious, potent, and pure; and Regulatory Enforcement and Animal Care is responsible for investigations of activities regulated by APHIS and the health and care of animals. Other USDA agencies include the Food Safety and Inspection Service (FSIS), the Grain Inspection, Packers and Stockyards Aministration (GIPSA), and the Agricultural Research Service (ARS). FSIS is responsible for meat and poultry inspections for food quality under the Federal Food, Drug, and Cosmetic Act of 1938. The GIPSA regulates the interstate commerce of livestock and poultry. The ARS is the research arm of USDA that conducts research on animal husbandry, develops diagnostic tests for the presence of disease, and studies the causes and the means of prevention and control of diseases and parasites. Outside of USDA is the Food and Drug Administration (FDA), which is part of the Department of Human Health Services. The FDA determines and enforces food purity standards in accordance with the Federal Food, Drug, and Cosmetic Act.

Table 1. Major Animal Diseases Eradicated in the United States

Disease	Year
Bovine pleuropneumonia	1892
Fowl plague	1929
Foot-and-mouth disease	1929
Glanders	1934
Dourine	1942
Cattle tick fever	1943
Vesicular exanthema	1959
Screwworm	
Southeast	1959
Southwest	1966
Venezuelan equine encephalomyelitis	1971
Sheep scabies	1973
Exotic Newcastle disease	1974
Hog cholera	1978
Lethal avian influenza	1985

With the advent of international agreements promoting the expansion of trade, such as the North American Free Trade Agreement (NAFTA) and the General Agreements on Tariffs and Trade (GATT), the demand for animal and animal products entering and leaving the United States is expected to increase. Being able to meet this increased demand will depend in large part on being able to maintain healthy livestock and poultry. Additionally, increased trade pressures from foreign markets mandate that FAD detection and response be maintained at least at the current levels. More efficient and rapid means of transporting products and animals also may contribute to a heightened threat of disease introduction. Under these circumstances, VS' capability to maintain an adequate level of security against disease introduction into the United States livestock and poultry markets becomes increasingly important.

Socioeconomic issues stem primarily from the potential impact of FAD and domestic disease on the U.S. agricultural economy, livestock and poultry industries, levels of production and resultant market effects, and effects on public confidence in the food supply.

Certain animal diseases, such as brucellosis, pseudorabies, and foot-and-mouth disease, have the potential to be transmitted to humans. Although animal/human transmissions are rare, protection from such transmissions is an important dividend of VS programs.

The societal value of wildlife, including economic, is also a reason to maintain an effective means of controlling and eradicating FADs. There are numerous FADs that are transmissible from livestock and poultry to wildlife species. In addition, a campaign to eradicate a disease could include the destruction of wildlife species that are known disease vectors.

C. Emerging Issues and New Technologies

As new technologies become available, APHIS VS will be actively involved in exploring ways to incorporate them into animal disease prevention, surveillance, control, and eradication programs. Program areas where new technologies are currently being evaluated and, in some cases used in a limited capacity, include animal identification and disposal.

1. Animal Identification

The development of information technology and the use of microprocessors has led to the testing and evaluation of electronic animal identification for animal disease surveillance and control. Automated means of identification have been used by some in the dairy industry (Bowers, 1985). These applications may replace metal tags and/or branding as a means of identification in some circumstances.

2. Carcass Disposal

The use of composting, fermentation, and rendering as alternatives to burning and burial are being evaluated. In the case of the poultry industry, the use of these disposal methods may be effective in eliminating the risk of water contamination associated with burial. In the case of diseased poultry, fermentation and composting also have been shown to be effective in pathogen destruction. The malodors resulting from burning also are reduced. Carcass-grinding on farms with tank truck transport to a rendering facility also is feasible.

Advances in incineration technology are providing alternatives to conventional burning processes and small incinerators. Portable, self-contained air curtain incinerator (ACI) systems provide the capability to dispose of large animals where burial and open-air burning are not

acceptable disposal options. ACI systems operate using recirculated forced air over the burn, producing an afterburner effect. This produces a hotter, more uniform fire. More importantly, this acts to further burn the organic particulates within the off-gases and greatly reduce air-borne emissions. Two types of ACI units are currently available. One type requires the use of a burial pit, while the other is a self-contained unit which operates completely above ground, requiring no excavation. Both units are fully transportable. Their use in carcass disposal would reduce any need for transport of carcasses from the site of destruction.

3. Trade Agreements

With the passage of NAFTA and ratification of GATT, VS' mission to exclude the entry of diseases and pests into the United States will not change. NAFTA and GATT are not expected to compromise the health of U.S. livestock and poultry, provided that accurate disease surveillance data is collected worldwide and scientifically applied to shipments of animals and animal products. Some of the concepts being examined by the International Committee of the Office of the International Epizootics are standardization of trade, regionalization, risk assessment, assessment of veterinary services, and the monitoring and surveillance of diseases and pests. The criteria for recognizing disease-free areas or zones (regionalization) will be based upon scientific fact and will be equally applied to all countries.

II. Alternatives

A. No Federal Action

The National Environmental Policy Act (NEPA) requires an agency to consider the No Action alternative (40 CFR § 1502.14). The consideration of the No Action alternative provides a baseline against which the effects of any other alternative can be measured.

Under the No Federal Action alternative, Veterinary Services (VS) would not participate in or fund any activity regarding the prevention, surveillance, control, or eradication of livestock and poultry diseases and pests.

Without the participation of VS, all animal disease or pest prevention, surveillance, control, or eradication efforts would be the sole responsibility of the States, industry, and other groups. Coordination of the above activities, including funding, also would be the full responsibility of these same participants, not VS. It is anticipated that the most significant impacts of No Action by VS would be in the areas of foreign trade and interstate commerce. The risks to domestic and foreign livestock, poultry, and wildlife would be increased with potential for serious losses to the domestic agricultural industry.

B. Proposed Action Alternatives

The Proposed Action is the continuation of VS participation in the prevention, surveillance, control, and eradication activities and their associated regulatory actions. Prevention, surveillance, control, and eradication are all considered specific and distinct alternatives within the overall scope of the proposed action alternative.

With the continued participation of VS with all aspects, the import/export activities would be regulated by VS. The regional emergency animal disease eradication organizations (READEO) would coordinate the planning of the eradication of disease or pest outbreaks and, when necessary, apply for extraordinary emergency funding. The diagnostic and training activities performed by the Federal laboratories pertaining to the identification of foreign diseases and pests would continue. VS would continue regular domestic programs for disease control, such as brucellosis, bovine tuberculosis, and pseudorabies.

However, in order to explore the range of alternatives regarding VS participation in activities, the following table displays the level of participation. VS participation within the scope of the proposed action alternatives would vary, and the level of involvement would be

determined on a case-by-case basis. In some cases the agency might act in an operational capacity in the eradication of a specific disease. Other scenarios might require that VS participation be limited to advice and expertise or the provision of funds.

The methods that are likely to be employed by the program within the four alternatives (prevention, surveillance, control, and eradication) are identified in Table 2. The methods described in this table also constitute those program activities identified in this EIS as having the potential to affect the human environment.

Table 2. Alternatives Matrix

	Alternatives			
Methods	**Prevention**	**Surveillance**	**Control**	**Eradication**
Observation and monitoring	X	X		
Inspection	X	X	X	X
Testing	X		X	X
Permitting	X		X	X
Health certificates	X		X	X
Vector control	X		X	X
Quarantines	X	X	X	X
Vaccinations	X		X	X
Depopulation and carcass disposal	X		X	X
Cleaning and disinfecting	X		X	X
Transportation	X		X	X

X denotes applicability
"Blank" is not applicable.

III. Affected Environment

The areas potentially affected by the implementation of the Veterinary Service (VS) program include agricultural, as well as nonagricultural lands, of all 50 States and the United States Territories (42 U.S.C. 4321-4347).

Environmental components within these areas that have some potential to be affected include a broad range of biotic and abiotic resources. Biotic resources include humans, domestic animals, wildlife, and plants. Abiotic resources that could be affected include air, water, and soils. Factors that may influence the consequences that VS activities may have on the resources are geography, topography, climate, and demographics.

Because this document is programmatic in scope, the specific affected environment and associated impacts with respect to individual activities cannot be strictly defined. Whenever VS activities are proposed for a specific area that have a potential for affecting the human environment, site-specific environmental assessments will evaluate the impacts of that proposed activity on the specific components of the affected area.

IV. Issues, Environmental Consequences, and Mitigation

A. Introduction

The Veterinary Service (VS) programs and activities, identified by the Animal and Plant Health Inspection Service (APHIS) and through the public scoping process, that have the potential to impact the human environment are: carcass disposal; emergency disease eradication; use of pesticides and disinfectants; import-export requirements; vaccinations; construction, use, and expansion of facilities; and animal identification. In this chapter the issues are considered along with any procedures and methods that may be used to mitigate any identified consequences.

Mitigation is defined by the Council on Environmental Quality in the National Environmental Policy Act (NEPA) regulations to include:

- Avoiding the impact altogether by not taking a certain action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
- Compensating for the impact by replacing or providing substitute resources or environments (40 CFR § 1508.20).

B. Carcass Disposal

1. Introduction

The disposal of livestock and poultry destroyed because of disease should accomplish two objectives. First, the carcasses must be disposed of in such a way as to destroy the pathogen and eliminate, to the greatest extent possible, the spread of disease and risk of transmission to other animals and wildlife and, in some cases, humans. Second, the disposal method chosen should be the most environmentally acceptable in regard to the local geography, topography, type of animal and disease, numbers of carcasses to be disposed, and disposal options available.

The method used to depopulate animals during a disease eradication or control campaign is independent of the method chosen to dispose of the carcasses. Specific methods of depopulation are not addressed as part of this EIS. Humane depopulation and euthanasia procedures are described in APHIS VS emergency disease guidelines for major animal diseases. These documents are available to the public upon request.

In most instances, the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS) involvement in the depopulation of large quantities of livestock and poultry and the subsequent disposal of carcasses occurs under emergency conditions precipitated by an outbreak of disease. In these cases, the only practical method to eliminate disease pathogens and adequately mitigate against disease spread is to destroy and dispose of individual animals or entire herds or flocks.

For the most part, disposal methods are discussed generically in this document. There is no alternative carcass disposal method that is universally preferred. The method chosen in a particular site-specific case will be dependent upon the type of animal, size of the herd or flock, the disease pathogen, and the characteristics of the site relative to potential negative environmental impacts. The Environmental Checklist for Carcass Disposal (in this section) includes a summary of these environmental considerations associated with various disposal methods.

Activities, such as the dimensions of burial pits or fuel requirements for burning, are specified within VS emergency disease guidelines for the diseases which APHIS VS regulates. Included in the guidelines are specific procedural steps that must be followed to dispose adequately of condemned carcasses. The guidelines also address individual worker safety by minimizing their exposure to pathogens when handling carcasses.

2. Alternative Disposal Methods

Alternative methods of carcass disposal include burial, burning, composting, fermentation, and rendering. These alternatives are discussed separately in the following sections, with the emphasis on potential environmental impacts that could occur in each case. There is no attempt made to determine a preferred method or alternative. That determination would be site-specific in nature and based on numerous factors and considerations, including, but not limited to, those described in this document.

a. Burial

If satisfactory sites are available, burial can be the safest, least expensive, fastest, and most convenient means of disposing of large numbers of livestock or poultry carcasses. It usually requires limited transport of animal carcasses and consequently does not risk disease spread during handling and transport. Proper burial also isolates the pathogen and prevents further spread by making it inaccessible to rodents and other scavenging animals.

Sanitary landfills provide a second method of carcass burial. A well maintained and managed sanitary landfill provides excellent control of rodents, scavengers, and insects that may spread a disease. Water drainage systems in sanitary landfills protect surface and groundwater from leaching of waterborne pollutants associated with carcass burial. If the volume of animal carcasses being disposed of is small relative to the total volume of the landfill, diseased carcasses can be safely disposed of in sanitary landfills (McDaniel, 1991). In some cases, carcasses may only be disposed of in landfills approved for this type of waste. State and local regulations and restrictions on the disposal of carcasses may limit available options.

Decomposition of Buried Carcasses. Regardless of the type of animal, the components of any buried carcasses will degrade naturally at varying rates. As is the case with most biological degradation processes, the decomposition rate is due in large part to ambient moisture and temperature conditions. McDaniel (1991) described four categories of animal carcass components based on the rate of decomposition.

The first category includes body fluids and soft tissue that are the first to decompose. This initial decomposition process produces liquids and gases that accumulate within the burial pit. If the soil cover of the pit is packed too tightly or improperly vented, pressures created during decomposition can result in large breaches in the cover because of escaping gases. This can expose the buried carcasses to rodents and other disease vectors. Gas build-up also reduces the specific gravity of the carcasses. If the burial pits are too shallow, parts of carcasses may float to the surface and become exposed. Shallow pits also lead to odor problems.

Fats comprise the second category. Fats will rise to the surface if they are not absorbed by the soil. Once above ground, fats may become entrained in surface runoff and may reach water bodies. As in the case of body fluids, proper burial depth is important in containing fats within the pit. Should fats reach the surface, refilling is required to eliminate the potential for runoff contamination and malodors.

The remaining categories include skin, cartilage, hair, feathers, bones, horns, and hooves. These components undergo slow degradation and decomposition but are not considered to have the potential to cause significant environmental problems (McDaniel, 1991).

The initial products of the decomposition of animal fats and proteins under anaerobic conditions are made up primarily of organic acids, carbon dioxide (CO_2), and hydrogen sulfide (H_2S). Intermediate products are made up of ammonia (NH_3), CO_2, and sulfides. The final stabilized products include NH_3, sulfides, CO_2, humus, and methane (CH_4). Under aerobic conditions, the initial decomposition products include NH_3, CO_2, and H_2S. Intermediate compounds include nitrite (NO_2), CO_2, and sulfur, while final stable products are nitrate (NO_3), CO_2, and sulfate (SO_4).

Environmental Impacts Associated With Buried Carcasses. Most of the contaminants associated with buried carcasses are waterborne. Common water pollutants include nitrate, ammonium (NH_4^+), phosphate, organic carbon, and bacteria.

Historically, pit disposal has been the most common method used by commercial poultry producers for disposing of dead animals.[1] A well designed pit disposal system will isolate carcasses adequately from disease carrying scavengers and rodents and protect surface water from contamination because of storm runoff. However, recent evidence has indicated that burial in disposal pits poses a threat to groundwater quality. Additionally, anaerobic conditions often develop in burial pits and instead of decomposing, they cause the carcasses to become mummified (Wilkes, 1993). If situated within a shallow groundwater system, these mummified carcasses may leach contaminants for an undetermined length of time. These operations are often concentrated geographically, which can exacerbate any environmental impacts of carcass disposal (Daniel, *et al.*, 1994).

Burial of poultry in an emergency depopulation potentially can present similar problems to routine pit disposal of carcasses because of incidental deaths.

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[1] *The livestock and poultry industry has some experience with water contamination due to carcass disposal, primarily with pit disposal of poultry carcasses. Incidental mortality (deaths occurring as a normal part of raising animals) within commercial poultry production cycles may run as high as three percent. Therefore, poultry producers are routinely faced with disposing of large numbers of animals due to various causes, among them disease. In the State of Arkansas, a three percent mortality rate among broiler chickens could equate to approximately 27 million dead chickens per year for disposal.*

Where burial occurs in close proximity to well systems, nitrate contamination of drinking water supplies is a potential consequence. Nitrate can cause methemoglobinemia, infant cyanosis, (or "blue baby disease") in humans who have been given water or fed formula contaminated with high levels of nitrate (Clarke, 1989). The U.S. Environmental Protection Agency has established a maximum contaminant level (MCL) of 19 mg/L as nitrate-N for domestic drinking water supplies (USEPA, 1986). Data from nonpoint source pollution studies have shown ammonium concentrations as high as 560 mg/L in shallow groundwater within 3 feet of poultry disposal pits (Arkansas Water Resource Center, 1993).

Poorly constructed burial sites located near streams, lakes, ponds, or above a shallow water table can constitute temporary point-sources of water pollution. In addition to nitrite and nitrate, ammonium (NH_4^+), bacteria pathogens, such as *Salmonella* spp., may leach into ground and surface water from a burial site. Other pathogens known or suspected to be waterborne include brucellosis (*Brucella* spp.), tuberculosis (*Mycobacterium* spp.), and anthrax (*Bacillus anthracis*) (Corbett, 1989).

Nitrogen over-enrichment of water bodies may stimulate the growth of algae and aquatic weeds. Excessive algal blooms can promote reduced oxygen levels in water bodies and have harmful effects on aquatic ecosystems. Ammonium that reaches ponds or streams through groundwater can be highly toxic to fish. Under certain temperature and pH conditions, NH_3 levels as low as 3 mg/L can cause mortality in trout (Daniel *et al.*, 1993).

The primary potential impacts posed by buried carcasses affect water supplies and aquatic ecosystems. From an environmental protection standpoint, local hydrology and topography will dictate the feasibility of burial as a means of carcass disposal.

b. Burning

Burning of animal carcasses produces a solid waste residue which is essentially free of putrid material. Benefits of burning or incineration include reduction in volume of the solid waste and reduction in the potential for groundwater pollution from components of the decomposing animal carcass. Additionally, burning and incineration ensure the near complete thermal destruction of pathogens.

Potential emissions from the burning of animal carcasses may be broadly classified into particulates, gaseous emissions, incompletely burned products from the combustion process, and trace emissions. Additionally, the unabated combustion of animals produces offensive odors that can create a public nuisance if conducted near populated

areas. Most of the airborne contaminants produced during carcass disposal result from open-air burning.

There are several methods used to burn carcasses. These include open-air burning, biological incineration, and controlled burning.

Open–air Burning. Open-air burning is conducted without regard to controlling off-gases and particulate emissions. Although many States and municipalities prohibit open burning, specific procedures used to burn large numbers of condemned carcasses have been devised and are described in APHIS VS emergency disease guidelines. These guidelines have been prepared by APHIS VS for major animal diseases that could require depopulation and disposal in the event of an outbreak. These publications are available upon request from VS, Riverdale, MD. Airborne contaminants resulting from the open burning of animal carcasses include those common to other sources. These include hydrocarbons, carbon monoxide, nitrogen oxides, sulfur oxides, and particulates. Although burning results in the destruction of most pathogens, significant reduction in volume of solid wastes, and minimizes potential impacts on water quality, there remains a residue which must be further disposed of either by composting, burying, or transporting to a landfill. As long as burning is complete, residues can be considered free of pathogens and putrescible material, and therefore, may be disposed of by burial with negligible effects on the environment (Dyer and Bruins, 1993).

Open-air burning of animal carcasses requires additions of combustible material, such as timbers and straw, as fuel additives to achieve sufficient temperatures to completely burn the animals. The smoke from these fires is extremely high in particulates and produces offensive odors. For these reasons, many State and local governments prohibit open-air burning.

Additionally, there is no assurance that open-air burning prevents further pathogen spread. Although the heat generated inactivates most pathogenic microorganisms, there has been at least one reported instance of aerosol transmission of a viable virus during burning of animals infected with foot-and-mouth disease. This aerosol transmission occurs during the initial heating stages when vapors are driven from the carcass pile (McDaniel, 1991).

Biological Incineration. Incineration is a method of thermal destruction of both the carcass and pathogen. Biological incinerators operate at extremely high temperatures, in excess of 2000°F in some cases. During the incineration process, when properly designed and operated, the combustible portion of the carcass is burned, producing a residue

free of pathogens. Incinerators use combustion to convert volatile gases, vapors, and particulates to carbon dioxide, water, and ash. The use of afterburner systems in incinerators also is effective in eliminating odorous compounds. A properly designed and operated incinerator will produce a stack gas virtually free of odors and particulate emissions. Modern incinerators achieve nearly complete oxidation, with destruction efficiencies as high as 99 percent (Corbett, 1989).

Access to an incineration facility with the required capacity may not be possible. Furthermore, the incineration process itself is expensive.

Controlled Burning. Controlled burning is a relatively new technology which has recently been applied in the destruction of large numbers of poultry carcasses. It also has been used by the USDA Forest Service for disposal of elk depopulated because of brucellosis. A gelled fuel is used to burn carcasses in a 4 to 6-foot deep trench. Gelled fuel offers two primary advantages over conventional fuels. First, it will not undergo rapid evaporation following application to the substance being burned. Secondly, it will not be as readily absorbed by the surface of substances as gasoline or diesel fuel. The fuel used in controlled burning is a mixture of gasoline and diesel fuel. The heat and length of the burn can be controlled by adjusting the ratio of the fuel components. Increased amounts of gasoline will provide a hotter burn, while increased amounts of diesel will produce a longer burn. As is the case with other burning techniques, the goal is to achieve temperatures that will burn body fats and other liquids as they drip from the carcass.

The products of controlled burning are non-combustible materials, such as ash and bone fragments. Once burning is complete, the trench is back-filled. Experience with controlled burning is currently limited. Efficiency improvements with increased experience can be expected. The process has been compared to that of a biological incinerator. By using controlled burning, the rapidity and temperature of the burning can be controlled and airborne emissions, including pathogens and particulates, are reduced. More definitive data on the constituents of controlled burning off-gases is lacking.

The potential environmental effects posed by the burning of condemned carcasses are airborne emissions and associated malodors, as well as aerosol pathogen transmission. The use of incinerators, when possible, will minimize if not eliminate these problems.

c. Rendering

The rendering process uses grinding action and high temperature and pressure to not only destroy the pathogen, but also yield valuable fats, proteins, and other products from the carcass. Following removal of fats, the remaining meat and bone meal can be used in the makeup of animal fodder. Since many of the by-products of rendering have commercial value, it may prove to be the most economical means of carcass disposal.

The rendering option obviously requires a facility with the capacity to dispose of the number of carcasses in question. A facility in close proximity to the site may not exist. The movement of the carcasses to a rendering plant introduces additional risk of spreading the disease agent during transport. (Blood, excrement, and other fluids may escape from carcasses when killed on farm premises). Transportation to the rendering facility must be carried out in biologically secure vehicles.

In the absence of immediate availability of rendering facilities, freezing of poultry carcasses is a management practice currently being developed. By freezing, the carcass and pathogen can be stabilized until a time when rendering can take place.

Because of the extreme temperatures achieved during the rendering process, most pathogenic organisms are destroyed. Significant exceptions, however, are the causative agents of spongiform encephalopathies, such as scrapie and bovine spongiform encephalopathy (BSE). A modified, more economical and efficient rendering procedure which uses reduced temperatures is believed to be unable to suppress the scrapie agent. Animal feed derived from the products of rendered scrapie infected sheep is thought also to have caused cases of BSE.

The potential environmental effects of the rendering process include airborne emissions and associated malodors. An additional potential problem is lack of available rendering facilities in the area of depopulation and the requirement for transportation in biosecure vehicles. Rendering offers economic benefits which other means of disposal do not, producing marketable products from the carcass.

d. Composting

Composting is the biodegradation of the organic constituents in a waste. During composting, carcasses are degraded through an aerobic process under controlled, confined conditions. Through the microbial activity taking place during composting, the animal carcass is decomposed into a stable, humus-like substance while at the same time the heat

produced results in pathogen destruction (Glysson, 1989). It is best suited for disposal of small animals and is commonly used by the poultry industry as an alternative to pit disposal for poultry carcasses. Large animal carcasses also can be disposed of by composting but require the additional step of being cut up into smaller pieces. In addition to the substance being composted, an additional carbon source is usually required. Wood shavings or sawdust are commonly used.

The heat generated during composting is the result of activity of thermophilic microorganisms. The heat normally generated in compost systems ranges from about 90 to 180°F (30 to 80°C). Poultry composting systems routinely generate temperatures in excess of 130°F (55°C). This temperature range is capable of destroying most of the pathogenic organisms found in diseased carcasses, such as bacteria, viruses, protozoa, and helminths. Composting can occur under anaerobic or aerobic conditions. Decomposition occurs more rapidly under aerobic conditions and does not produce the malodors commonly associated with the by-products of anaerobic decomposition (Glysson, 1989). Relatively cold ambient temperatures will usually not affect the composting process unless the carcasses become frozen (Muirhead, 1993). In regions that normally experience high precipitation or when rainfall occurs in periods of high intensity, the process can still function normally; however, the composting units should have overhead cover.

Composting has been proven to mitigate against potential water contamination in the disposal of large numbers of poultry. If designed and operated correctly, composting units offer an environmentally sound alternative to burial and burning. The composted by-product also may provide economic incentives. The size of the animals to be disposed of can be a limiting factor, as can be local climatic factors.

e. Fermentation

Fermentation is the breakdown of organic material through bacterial action. Lactic acid fermentation has been successfully used by the poultry industry for on-the-farm disposal of chicken and turkey carcasses as an alternative to pit burial. In the fermentation process, carcasses are ground through a meat grinder, after which a carbohydrate source, such as sugar, whey, molasses, or ground corn is added. Grinding produces particle sizes needed for fermentation and releases intestinal lactic acid-forming bacteria to initiate the process (Scheid, 1993). The fermentation process promotes nutrient recovery, and the bacteriocidal activity produced by decreased pH levels yields an end product which is pathogen free (Murphy and Silbert, 1992). The most common microorganisms that are pathogenic to poultry, including *Salmonella*, are normally destroyed.

The end product of the fermentation process can be used as an animal feed ingredient. The advantages of fermentation are similar to composting. It provides a safe alternative to burial and burning and produces a marketable by-product. It is limited by the size and numbers of the animal carcasses involved.

3. Disposal Considerations

Because of the programmatic nature of this document, specific characteristics listed below which can affect the potential for and degree of environmental impacts cannot be addressed in a site-specific context. However, each of these considerations will be addressed relative to its significance in determining the most environmentally safe method of carcass disposal.

a. Soil Type

Local soil conditions directly influence the potential for products of decomposition to leach into groundwater. In many areas of the United States, for example, thin top soil layers and Karst conditions predominate. These conditions would increase the potential for disposal methods, such as pit burial, to adversely affect water quality. Such soil conditions could eliminate burial as an environmentally benign disposal alternative. In areas of high soil permeability, disposing of carcasses above ground by composting, burning, or rendering would be an effective means of mitigating against threats to water quality.

b. Surface and Subsurface Hydrology

Surface water conditions, such as the proximity of the disposal site to lakes, streams, wetlands, or ponds, will affect the potential for water contamination because of the by-products of decomposition. Surface water gradients in the immediate vicinity of the proposed disposal site should be considered when determining the feasibility of burial as a disposal option.

The subsurface hydraulic gradient, geology, depth to groundwater, and existence of perched water tables should be known when considering carcass burial operations.

c. Climate

Local climatic conditions may dictate the means of disposal or require modifications to the selected process. Extreme cold temperatures may make composting or fermentation impractical; however, it has been shown that poultry, including turkeys, can be successfully composted in the cold-weather conditions of the Upper Midwest (Muirhead, 1993). Frozen soil may make burial more difficult or require heavy equipment not otherwise necessary.

Precipitation levels can have several influences on water quality impacts. Large amounts of precipitation will exacerbate any migration of contaminants caused by runoff. In areas where the water table fluctuates significantly, burying carcasses during periods of heavy rain may be impractical. Additionally, composting or fermentation operations in areas of high precipitation would require overhead cover.

d. Local Environmental Regulations and Restrictions

Environmental protection measures, regulations, and restrictions can vary significantly by State and local municipality. In order to conduct an expedient, effective, and environmentally safe depopulation and disposal operation, these factors must be considered in advance. Sources of this information are identified in this section in the Environmental Checklist for Carcass Disposal.

e. Manure and Debris Disposal

The potential for animal manure to negatively impact aquatic environments and well water supplies is well known. The primary pollutants associated with manure are nitrate and ammonia-nitrogen, phosphorus, pathogens, and organic enrichment. As is the case with carcasses themselves, the destruction or isolation of pathogens in manure and debris must be accomplished in order to protect against the infection of healthy animals.

Normal manure handling procedures are varied according to numbers and types of animals. These methods include land application as fertilizer, composting, and digestion in lagoon systems. Depending on the animal disease in question, normal procedures may be sufficient to destroy the pathogen. For example, if composting is routinely used to dispose of animal carcasses, the manure from diseased animals can be disposed of in this manner as well; however, land application of either liquid or solid animal wastes may prove problematic because of heightened potential to contaminate water supplies. Although the frequency of exposure and infection from field applications of animal waste is low, the potential is considered to be greater through contaminated water supplies (USDA, SCS, 1991).

Burial and burning offer alternative disposal methods for animal waste and debris. The potential impacts and considerations described for the burial and burning of carcasses are applicable to manure and debris as well.

f. Transportation

Biosecurity during the transportation of diseased carcasses becomes an issue in some instances because of the risk of spreading the disease

agent. This is obviously the case whenever carcasses must be moved off the premises to suitable burial sites or transported to rendering or incineration facilities.

g. Wildlife

Disposal of diseased carcasses must ensure that those pathogens not rapidly destroyed as part of the disposal process are securely isolated to mitigate against transmission to susceptible wildlife species. There are several diseases for which APHIS VS is responsible for control, surveillance, and eradication that are transmissible to certain wildlife species. Brucellosis and tuberculosis are good examples.

h. Greenhouse Gas Generation

The by-products of the process of buried carcass decomposition, as well as burning, produce emissions classified as "greenhouse gases." These include nitrogen and sulfur compounds, as well as carbon dioxide. Because of the relative infrequency of the depopulation and disposal of large numbers of animals, the levels of greenhouse emissions caused by APHIS VS carcass disposal activities can be considered negligible.

4. Alternatives

Table 3 describes each disposal method with regard to selected areas of potential environmental effects. Since this document is programmatic in nature, it is not realistic or possible to account for every conceivable situation that may arise, such as numbers and types of animals and local climatic conditions, as well as State and local environmental laws and regulations. Rather, the intent is to provide guidance on potential areas of environmental concern which should be considered when evaluating various carcass disposal methods.

The evaluation scoring scheme was adopted from Dyer and Bruins (1993). The (+) indicates a positive or beneficial attribute. For example, proper burial of carcasses serves to eliminate or reduce odors and thus has a positive impact relative to odor control. Multiple (+)s are indicative of degree. Negative or detrimental environmental effects are described as L (low), M (medium), or H (high) relative to one another. NA means non applicable.

These estimates are not intended to indicate preferred alternatives. Burning has obvious detrimental impacts on air quality and odors, and the impacts of burning on these criteria are described as high (H). Burning, however, may be the preferred alternative in areas where groundwater resources are easily threatened because of a high or fluctuating water table or highly permeable soils.

Table 3. Disposal Methods Matrix

Method of Disposal	Pathogen Destruction	Odor Control	Air Emissions	Groundwater Effects	Economic Benefit	Wildlife Protection
Burial	+	+	+	M	NA	+
Open-air Burning	+	H	H	+	NA	++
Controlled Burning	++	M	M	+	NA	++
Incineration	++	L	L	+	H	++
Rendering	+	L	+	+	+++	++
Composting	+	L	+	+	++	+
Fermentation	+	L	+	+	++	+

5. Mitigation and Other Disposal Considerations

This section describes in general terms those actions taken within the VS program to mitigate environmental harm. Because of the programmatic nature of this document, the specific characteristics listed below, which can affect the potential for and degree of environmental impacts, cannot be addressed in a site-specific context. However, each of these considerations will be addressed as to its significance in determining the most environmentally safe method of carcass disposal.

Table 22 identifies those resources and issues that may require the use of mitigating measures in order to receive adequate protection from harmful environmental effects. This list is considered comprehensive; however, actual mitigation measures and actions that occur at the program level are not comprehensive or exhaustive in scope. In other words, site-specific cases may require the design and implementation of mitigating measures not described in this document.

a. Resources

Water. Water resources include rivers, lakes, streams, estuarine areas, wetlands, as well as groundwater and well systems. Disposing of animal carcasses by burial creates the greatest potential for contamination of water resources.

Taking steps to mitigate the effects of carcass burial on water resources assumes that there is no other option reasonably available. In instances where water resources may be impacted because of carcass burial, the most obvious mitigating action would be to choose another

method if practicable. In most cases, the location and depth of a burial pit will have the greatest effect on mitigating impacts to water resources. Burial in areas that are immediately adjacent to surface water features should be avoided. Surface water gradients in the immediate vicinity to the proposed disposal site also should be considered when determining the feasibility of burial as a disposal option. The topography and geology in the immediate vicinity of the burial site also will govern the migration of waterborne contaminants. Avoiding sites characterized by steep slopes and/or permeable soils can serve to contain or reduce the movement of contaminants until they degrade to innocuous levels.

Knowledge of subsurface hydrology of the burial site also is important. This includes information such as the subsurface hydraulic gradient, depth to groundwater, and existence of perched water tables. Burial in groundwater recharge areas should be avoided.

Air Resources. Several methods of carcass disposal can have impacts on air resources. In the cases of burial, composting, and fermentation, the principle sources are off-gases from the various decomposition processes. The predominant sources of airborne contaminants, however, are the burning and, to a lesser extent, rendering of animal carcasses and body parts.

The open-air burning of animal carcasses is prohibited in many parts of the country and is otherwise no longer an accepted practice; however, burning of carcasses using procedures specifically modified to reduce particulate emissions are used in some instances. These include air curtain incinerator methods and controlled burning described earlier in this chapter.

Human Health. Potential human health effects result from handling of diseased carcasses or contact with water supplies contaminated by buried carcasses. Therefore, only APHIS VS personnel, either veterinarians or animal health technicians, who are trained to handle animals with the disease in question will handle those animals. Furthermore, proper carcass burial will ensure that no surface or groundwater resources will be affected to an extent that human health would be impacted.

Although the methods used to burn or incinerate carcasses may produce some particulate emissions, only those methods that can meet the local air quality standards would be used on a site-specific basis. As such, human health should not be affected as a result of airborne emissions. Since rendering facilities and incinerators used for the disposal of

carcasses and animal parts operate under the appropriate permitting requirements, no adverse effects on human health are anticipated.

Wildlife. Wildlife may become disease vectors if carcasses are improperly buried. Should burial pits be of inadequate depth, exposed animal parts can become available to scavengers. Additionally, aquatic species could be affected should surface water bodies receive increased ammonia levels because of decomposing animal tissues in a nearby burial site. In each of these cases, proper burial procedures (sufficient depth and distance from water resources) will reduce the potential for impacts on wildlife.

Cultural and Historical. Any potential damage to cultural and historical resources can be avoided by contacting the appropriate agencies prior to selecting a disposal site. These would include historical preservation offices and archaeologists at the State level as well as local universities. The proximity of a proposed disposal site to cultural or historical resources may dictate the disposal method chosen.

Vegetation. Damage to vegetation can result from the construction of pits for use in either burial or burning of animal carcasses. In most instances these effects can be considered short term and negligible. An obvious exception, however, is the removal or destruction of endangered or threatened plants. Consultation with proper State agencies and the U.S. Fish and Wildlife Service prior to choosing the burial or burning pit site will eliminate any impact to protected plant species.

b. Other Disposal Considerations

Utilities. The type and location of local utilities are considerations when determining the location of a disposal site. This is particularly true in the case of burial pits for either burning or burying carcasses. Knowledge of the location of buried gas lines, electrical cabling, storage tanks, or fuel conduits, prior to excavation of any kind, is a legal requirement in most areas. This requirement would serve to eliminate or mitigate any collateral environmental impacts caused by damage to utility infrastructures during the construction of burial pits.

Compensation. Economic losses incurred because of livestock and poultry animal depopulation may be mitigated through indemnity payments to owners. In addition to the animals themselves, claims also may include the costs of burial, burning, or other disposition and the value of other materials destroyed during disposal. Appraisals, claims, and payments are specific to the disease or program in question.

6. Environmen– tal Checklist for Carcass Disposal

a. Purpose

This checklist is intended as a field guide to help quickly identify environmental issues associated with the following carcass disposal methods that could be used in emergency situations:

- Burial
- Burning, including controlled, incineration, open-air
- Composting/fermenting
- Rendering

Use of this checklist will help to integrate environmental concerns into the planning and decisionmaking process. Furthermore, it will assist in identifying potentially negative consequences that then can be avoided, minimized, rectified, reduced, or compensated.

b. Environmental Resource Issues

Ten environmental resource issues have been highlighted in this checklist to ensure they are considered in evaluating the preferred method or methods of disposal. They are:

- Surface water, including wetlands
- Groundwater, including soils
- Air quality, including odor
- Wildlife, including endangered species
- Public health/worker safety
- Vegetation
- Solid waste
- Cultural resources/historical preservation
- Climate
- Utilities

c. Environmental Assessments

The checklist is provided to assist environmental assessment (EA) preparers in the identification of the environmental issues and resources that may be encountered whenever they are planning carcass disposal activities. The user of this checklist is cautioned, however, that it may not include considerations for all environmental issues and resources that may be encountered in the development of an EA. Many times a site-specific analysis will disclose issues and resources that are very unique to the locality, and these may not have been identified in this checklist. It is imperative that any carcass disposal method for which APHIS partially or wholly finances, assists in, conducts, regulates, or approves, be in compliance with applicable Federal, State, and local environmental laws or statutes.

d. Application

First Steps

The first step prior to using this Environmental Checklist is to understand the parameters of the problem and potential solutions. For example:

- What disease is involved, and how can the pathogen best be destroyed?
- What are the number and type of carcasses involved?
- Are rendering plants or incinerators of sufficient capacity nearby and available?
- Is biosecure transportation available?
- What is the size of the burial pits and amount of soil cover required?
- What fuel is available?
- What Federal, State, and local permits are necessary?

How To Use It

The next page displays a matrix of the four carcass disposal methods combined with the ten environmental resource issues. The "X" denotes that the particular issue is likely to be relevant to that disposal method. For example, for burial, ten issues are likely to be relevant. Whereas for rendering, only surface water, air, and public safety/worker health issues apply. Again, the judgement and field experience of VS officials and that of other local environmental experts should be employed. Use the matrix as a guide and a starting point.

Table 4. Issue Matrix

Resource	Method			
	Burial	**Burning**	**Rendering**	**Composting/ Fermentation**
Surface Water	X		X*	
Groundwater	X			
Air	X	X*	X*	X
Wildlife	X			
Public Safety and Worker Health	X	X	X	
Solid Waste	X	X		X
Vegetation	X	X		
Cultural and Historical	X	X		
Utilities	X	X		
Climate	X	X		X

X denotes applicability; X* requires all Federal, State, and local discharge permit requirements to be satisfied in order to mitigate or eliminate any impacts. Blanks denote non-applicability.

Specific Resources

Once you have identified your carcass disposal options and their relevant environmental resource issues, proceed to the more detailed list of issues that identifies the most important aspects of the issue (for example, for surface water these are: lakes, streams, wetlands, and estuarine areas), as well as the most important considerations. The "Sources of Information" have been included to assist in identifying and characterizing the site-specific conditions for a particular situation.

Surface Water

Lakes
Streams
Wetlands
Estuarine areas

Considerations

Proximity
Gradients
Sensitivity
Topography (slope, floodplain)
Pesticide/disinfectant use

Sources of Information

U.S. Geological Survey
U.S. Environmental Protection Agency
U.S. Army Corps of Engineers
State/local water quality control board or agency
State engineer

Groundwater

Wells
Recharge areas

Considerations

Quality of the aquifer
Depth to groundwater
Connection to surface water
Soils (type, permeability, depth)
Geology (rock, type, porosity)
Pesticide/disinfectant use

Sources of Information

U.S. Geological Survey
U.S. Environmental Protection Agency
U.S. Army Corps of Engineers
State/local water quality control board or agency
State engineer
Soil Conservation Service
Local universities
Extension offices

Air Quality

Gases
Particulates
Odor
Visibility

Considerations

National Ambient Air Quality Standards (NAAQS)
Distance to population centers/density
Fuel type and related emissions

Sources of Information

State/city air quality/health agencies
U.S. Environmental Protection Agency
Local universities
Local fire departments
National Weather Service

Wildlife

Endangered and/or threatened species
Habitat
Aquatic species
Scavengers and other disease vectors

Considerations

Species, range, and number of wildlife
Disease transmission
Consultation with U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service under Section 7 of the Endangered Species Act
Sensitivity
Exposure
Pesticide/disinfectant use

Sources of Information

U.S. Fish and Wildlife Service
State wildlife agencies
Local universities
National Wildlife Federation
Audubon Society

Public Health and Worker Safety

Considerations

Disease transmission (air, water, wildlife, vectors)
Fire hazard
Distance to population centers
Local utilities
Use of machinery
Transportation (biosecurity)
Pesticide/disinfectant use

Sources of Information

Centers for Disease Control
State/local health departments
Fire department
Occupational Safety and Health Administration
U.S. Environmental Protection Agency
Public works
Local utilities

Vegetation

Endangered and/or threatened plants
Revegetation

Considerations

Vegetation types, numbers, and sensitivity
Consultation with U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service under Section 7 of the Endangered Species Act
Fire hazard

Sources of Information

U.S. Fish and Wildlife Service
Soil Conservation Service
Local universities
Local fire department
County extension office

Solid Waste

Animal waste and debris
Combustion residues

Considerations

On-site disposal or landfill
Waste quantity and composition
Waste classification

Sources of Information

Local universities
Public works
U.S. Environmental Protection Agency

Cultural Resources and Historic Preservation

Considerations

Nearby historic building or structures
Archaeological sites

Sources of Information

State archaeologist
State historic preservation officer
Local universities

Utilities

Considerations

Buried or above ground gas, electric, water, sewer, telephone, or cable lines, well and septic systems

Sources of Information

Public utilities
Public works
Landowners

Climate

Considerations

Precipitation
Temperature
Wind
Fire hazards
Local forecast

Sources of Information

National/local weather service
Local fire department

C. Use of Chemicals in Veterinary Services Programs

1. Introduction

In this section only, citations concerning the information will appear after each main topic. The citations are designated by a number that corresponds to a specific reference. These references are on page 64 of this document.

The chemicals applied in VS programs are primarily designed to eliminate potential routes of introduction and/or spread of certain diseases and pests. Introduction of these diseases or their vectors poses a significant risk to U.S. agriculture. Response to the perceived threats posed by these diseases or organisms is, of necessity, immediate and direct. There are no differences in the methods of application between routine procedures and emergency treatments, so the environmental issues and potential consequences will be comparable. Although the magnitude of risk to United States agriculture may differ between routine and emergency treatments, the hazards presented by such application are the same. The potential risks from a given program will depend primarily on the magnitude of treatments (*i.e.*, number and size of treatments). Quantification of the potential risk is important in site-specific or program-specific Eas, but this quantification of risk could not be accurately portrayed at the programmatic level of this document. Instead, the potential hazards of specific treatment methods will be presented to guide preparers of site-specific (or program-specific) EAs or environmental impact statements (EIS)s to those critical issues that should be considered in VS programs.

Chemicals in VS programs are applied either directly to imported livestock and poultry or to articles or sites potentially contaminated by these animals with disease organisms, disease vectors, or pests. A general description of the chemicals used in VS programs is given in Table 5. The chemicals above the double line in the table are pesticides; those below it are disinfectants.

Table 5. Description of Chemical Uses in VS Programs

Chemical	Pest/Disease[1]	Site/Treated	Application Method
Amitraz/Taktik®	Ticks and mites	Cattle in Puerto Rico	Spray-dip machine or spray
Carbaryl/Sevin®	Nonindigenous ticks	Ostriches and other ratites at Ports of Entry, also premises	Dust

Chemical	Pest/Disease[1]	Site/Treated	Application Method
Chlorpyrifos/ Dursban®	Fever ticks and other ticks	Premises and vehicle treatment; cattle and other livestock in Texas	Spray emulsifiable concentrate (EC)
Coumaphos/Co-Ral®	Ticks	Cattle, horses, goats, sheep on Texas/Mexican border	Dip or spray [25% wettable powder (WP) or Flowable]
Crotoxyphos/ Ciodrin®	Ticks and mites	Cattle, sheep, goats	Dip
Ivermectin/Ivomec®	Scabies mite	Cattle, hogs, sheep, goats	Injection or oral treatment
Lime sulfur	Scabies and psorergatic mites	Dairy cattle, sheep	Wash or spray
Permethrin/ Atroban®	Ticks and mites	Cattle, sheep, goats, horses	Spray (EC), wipe-on, nasal application
Phosmet/Prolate®	Ticks and mites	Cattle, hogs	Dip
Calcium hypochlorite	FMD, VE, TD, AHS		Disinfectant
Chlorinated lime	General and ticks	Cars, boats, premises	Disinfectant
Cresylic disinfectant	Ticks/BR, SE, VVND, HC, TB	Cars, boats	Disinfectant
	SF	Premises	
Formaldehyde		Bird feathers on skin	Disinfectant
Hydrochloric acid	FMD	Hides, skins, animal casings	Disinfectant
Iodine	VE		Disinfectant
Phenol	Ticks	Cars, boats, premises	Disinfectant
Sodium bicarbonate		Animal casings	Disinfectant

Chemical	Pest/Disease[1]	Site/Treated	Application Method
Sodium bifluoride	FMD, ASF	Hides, skins	Disinfectant
Sodium carbonate		Only aircraft disinfectant with sodium silicate	Disinfectant
Sodium carbonate	FMD, VE, RP	Cars, boats, premises	Disinfectant
	ASF	Hides, contaminated surfaces	Disinfectant
Sodium hydroxide	SVD, HC, FMD, VE, AN, BL, RP	Cars, boats, premises	Disinfectant
	ASF	Hides, contaminated surfaces	Disinfectant
Sodium hypochlorite	SVD		Disinfectant
Sodium ortho-phenylphenate	IL, HC, VVND, TB	Premises	Disinfectant
Sodium silicate		Only aircraft disinfectant with sodium carbonate	Disinfectant
1-Stroke Environ	VVND, HC, ASF		Disinfectant

[1]Abbreviations for diseases:

AN = Anthrax
AHS = African Horse Sickness
ASF = African Swine Fever
BL = Blackleg
BR = Brucellosis
FMD = Foot-and-Mouth Disease
HC = Hog Cholera
IL = Infectious Laryngotracheitis
RP = Rinderpest
SE = Swine Erysipelas
SF = Shipping Fever
SVD = Swine Vesicular Disease
TB = Tuberculosis
TD = Teschen Disease
VE = Vesicular Exanthema
VVND = Velogenic Viscerotropic Newcastle Disease

Analyses of the potential risks from application of these chemicals in VS programs will be presented in this section by method of application. The chemical applications can be broadly divided into pesticides and disinfectants. The pesticide applications include dips, sprays, dusts, washes, topical treatments (wipe-ons and nasal treatments), and systemic treatments (injections and oral treatments). Each of these application methods involves direct treatments of animals. Applications by sprays and dusts also are applied to common carriers, premises, and fomites (inanimate objects that have become infested or contaminated). Likewise, disinfectants are applied to common carriers, premises, and fomites. Each application method will include a brief description of how the chemicals are applied, the environmental fate, the potential routes of exposure for humans and non-target species, the resulting hazards, and the approximate potential for exposures from activities in VS programs to pose such hazards.

Environmental Fate and Routes of Exposure. Assessment of potential risk from given chemical applications requires knowledge of the concentrations and movement of the applied chemicals in the environment. This information is used to determine effects on environmental quality and to determine the potential exposure of humans and other organisms. Exposure information combined with hazard data for the chemical is then used to determine the potential risks of the application to living organisms that could be exposed.

The physical and chemical characteristics of the chemical compound are critical to determining the environmental fate and possible routes of exposure. For example, compounds that have low vapor pressure are less likely to volatilize. These compounds will have lower concentrations in air than compounds with high vapor pressures. As a result, exposure of organisms to these compounds in air will be low. Analysis of the characteristics of each chemical was done for selected environmental components to determine fate and potential exposures. The components selected for analysis were limited to those most likely to pick up pesticide residues based upon program experience and pesticide application method. The margins of safety of the pesticides to the livestock, as determined through testing and registration, indicate that these compounds pose negligible risk to the animals treated.

Regardless of application method, the proper handling and storage of pesticides can minimize most potential exposures.

Potential Hazards. The hazards relate to physical and chemical characteristics, toxicity, and environmental fate and transport. Based on the application method, there are certain critical factors used to determine potential hazards. The hazard estimates are then used to determine increased or decreased risk. For example, the critical factor to analyses of amitraz concentrations in air from dip treatments is the physical characteristic of low vapor pressure. This characteristic of amitraz indicates that concentrations of the pesticide in the air will be low and the potential hazards to air quality will be minimal. Hazards to livestock are not considered here.

The magnitude of hazard determines the potential environmental risk. If the potential hazard to an environmental component from treatment with a given pesticide is negligible, then the environmental risk is likely to be very low. The hazard classifications in this programmatic document are designed to assist in the assessment of site-specific or program-specific EAs or EISs.

Environmental components for given applications that are identified as having no environmental hazard (not identified) or negligible environmental hazard probably could be classified as components with no adverse environmental effects (no significant risk) for purposes of risk assessment without conducting any further quantitative or qualitative analyses. Analysis of environmental components that are identified as having slight environmental hazard could probably be completed qualitatively to determine if any adverse effects are likely. Environmental components identified as having low environmental hazards are components which normally would not be expected to pose adverse environmental risk but could pose considerable environmental risk under certain circumstances. Environmental components identified as having moderate environmental hazard are likely to pose some environmental risks and should be further analyzed if site-specific environmental documents are prepared. Environmental components identified as having high environmental hazard are at considerable environmental risk and would require analysis in site-specific or program-specific documents. The risk to specific environmental components from pesticides can always be mitigated by actions taken in site-specific or program-specific situations to minimize exposure. (1, 3, 7, 10, 14, 23, 24, 50, 55, 74, 80, 103, 107, 109, 112, 130, 131, 137, 138, 141, 143, 156, 159, 162, 163, 165-183, 189).

2. Pesticides

a. Dip Treatments

Chemicals applied as pesticides to animals by dip treatments include amitraz, coumaphos, crotoxyphos, and phosmet. Most dips involve the immersion of animals in a vat containing water and acaricide. The animals are usually forced through gates to swim across the vat with

total submergence and emerge from the vat through a gate on the opposite side. In addition to this method, there is a spray-dip machine used to apply amitraz to cattle in Puerto Rico. This machine assures that the body and head will be completely treated against ticks and mites. The animals often shake off residual acaricide upon leaving the spray-dip machine. In the case of a swim-vat, animals are run into the catch areas that are designed to recycle residual acaricide back into the vat. The contents in the vats after treatment contain residual acaricide that should be disposed of properly. This is of particular concern for treatment vats in Mexico just across the U.S. border and at other foreign locations where regulations regarding disposal of these contents are not as stringent as the requirements of the U.S. Environmental Protection Agency (USEPA) (7 U.S.C. §136q).

Environmental Fate and Routes of Exposure. The environmental fate of pesticides used in dips and the route of transport or exposure for given environmental components are presented in Table 6.

Table 6. Environmental Fate of Pesticides Applied as Dips in VS Programs

Environmental Fate Component	Route of Transport/Exposure
Air	Volatilization and drift
Mixer/loader	Preparation of formulation and placement in vats or spray-dip machine
Applicator	Exposure to residues while herding animals in and out of vats or spray-dip machines
Soil/vegetation	Animals shaking or rubbing off residues
	Excretion of residual pesticides by animals
	Cleaning and disposal of residual pesticide contents of vats or spray-dip machines after treatment of animals
Groundwater	Cleaning and disposal of residual pesticide contents of vats or spray-dip machines after treatment of animals
Birds (*i.e.*, cattle egret)	Exposure from standing or feeding on arthropods on backs of treated livestock

Environmental Fate Component	Route of Transport/Exposure
Nontarget terrestrial invertebrates	Exposure to residual pesticide from treatment or disposal practices

In addition to fate in air, there are several other important environmental components to consider for dip treatments. Despite adherence to pesticide label instructions, exposures of the preparers of the pesticide formulation (mixers and loaders) and of the applicators to pesticide residues must be analyzed. There are several potential routes by which pesticides from dip vats may be transported to soil or vegetation. Residues of the pesticide from the vats may be released to soil or vegetation by the treated animal through physical transport or excretion. Residues may adhere to soil or vegetation from splashing of vat contents during treatments or from vat cleaning and disposal procedures. Proper cleaning and disposal of treatment vats is of particular concern. Improper disposal of vat contents can result in contamination of groundwater with pesticide residues.

The nontarget organisms most likely to be exposed to pesticides from dip treatments are certain species of birds and terrestrial invertebrates. In particular, the cattle egrets are known to perch on the backs of cattle and feed on their ectoparasites. These birds could be indirectly exposed through the residues on the cattle or residues on any ectoparasites that the birds choose to consume. The proper handling of pesticide can minimize most potential exposures. Components of the environment unlikely to pick up residues from dip treatments are not presented. In particular, surface water quality and aquatic components are not expected to be affected by dip treatments if proper handling and safety precautions are followed.

Potential Hazards. The potential hazards to given environmental components from each pesticide used in dip treatments are presented in Table 7. The potential hazards to abiotic components such as air refer to the potential adverse effects on environmental quality. The potential hazards to humans (mixer/loaders and applicators) refer to potential adverse health effects. The potential hazards to wildlife (birds and nontarget terrestrial invertebrates) refer to potential adverse effects on survival of the species (8, 9, 12, 21, 28, 29, 38, 40, 41, 44, 46, 50, 53, 55-60, 63, 65, 67, 68, 71, 84, 87, 94, 95, 99, 102, 104, 105, 108, 109, 112, 120-122, 126, 127, 130-132, 135, 138, 140, 141, 145, 149, 160, 163, 165, 171, 173-175, 182).

Table 7. Potential Hazards of Pesticides Applied as Dips in VS Programs

Chemical	Environmental Component	Critical Factors and Potential Hazards
Amitraz	Air	Low vapor pressure: negligible hazard
	Mixer/loader	Slight to moderate acute toxicity; low absorption and rapid excretion, synergistic effects, borderline Group C/D carcinogen: low acute hazard, slight chronic hazard
	Applicator	Slight to moderate acute toxicity; low absorption and rapid excretion, synergistic effects, borderline Group C/D carcinogen: low acute hazard, slight chronic hazard
	Soil/vegetation	6 hour half-life on wet soil: negligible hazards from residues spread by animals; slight to moderate hazards for improper cleaning or inadequate disposal
	Groundwater	Slow leaching to groundwater: slight to moderate hazards for improper cleaning or inadequate disposal
	Birds	Very slightly to slightly toxic to birds: negligible hazard for likely exposure routes
	Nontarget terrestrial invertebrates	Selectively toxic to ticks, mites, and hoppers: high hazard to sensitive species exposed; low hazard for most species with proper handling of pesticide
Coumaphos	Air	Very low vapor pressure: negligible hazard
	Mixer/loader	Moderate to severe acute toxicity; rapid excretion, synergistic effects, mild eye and skin irritation: moderate acute hazard
	Applicator	Moderate to severe acute toxicity; rapid excretion, synergistic effects, mild eye and skin irritation: moderate acute hazard
	Soil/vegetation	Readily binds to soil organic matter: negligible hazards from residues spread by animals; moderate hazards for improper cleaning or inadequate disposal

Chemical	Environmental Component	Critical Factors and Potential Hazards
	Groundwater	Moderate to severe hazards for improper cleaning or inadequate disposal
Coumaphos (*continued*)	Birds	Moderate to severe toxicity: slight hazard from likely exposure routes
	Nontarget terrestrial invertebrates	Moderate to severe toxicity: high hazard to sensitive species exposed; low hazard for most species with proper handling of pesticide
Crotoxyphos	Air	Adsorbs readily to liquid/solid surfaces: negligible hazard
	Mixer/loader	Moderate to severe acute toxicity; rapid excretion, synergistic effects: moderate acute hazard
	Applicator	Moderate to severe acute toxicity; rapid excretion, synergistic effects: moderate acute hazard
	Soil/vegetation	8 day half-life on wet soil: negligible hazards from residues spread by animals; moderate hazards for improper cleaning or inadequate disposal
	Groundwater	Moderate to severe hazards for improper cleaning or inadequate disposal
	Birds	Moderate toxicity: negligible hazard from likely exposure routes
	Nontarget terrestrial invertebrates	Severely toxic to ticks, mites, lice, and flies; moderate toxicity to honey bees: high hazard to sensitive species exposed; low hazard for most species with proper handling of pesticide
Phosmet	Air	Low vapor pressure: negligible hazard
	Mixer/loader	Moderate acute toxicity; rapid excretion, synergistic effects, mild eye irritant, "tentative" category C—possible human carcinogen: low acute hazard, low chronic hazard
	Applicator	Moderate acute toxicity; rapid excretion, synergistic effects, mild eye irritant, "tentative" category C—possible human carcinogen: low acute hazard, low chronic hazard

Chemical	Environmental Component	Critical Factors and Potential Hazards
	Soil/vegetation	3 to 12 day half-life on soil; rapid degradation on plants: negligible hazards from residues spread by animals; slight to moderate hazards for improper cleaning or inadequate disposal
Phosmet (*continued*)	Groundwater	Moderate hazards for improper cleaning or inadequate disposal
	Birds	Slight to severe toxicity: slight hazard from likely exposure routes
	Nontarget terrestrial invertebrates	Severely toxic to most insects: high hazard to sensitive species exposed; low hazard for most species with proper handling of pesticide

The hazards posed by dip treatments relate primarily to the pesticide used. There is moderate acute hazard for coumaphos and crotoxyphos. Proper handling and safety precautions should be followed closely in the use of these pesticides to minimize exposure. All four pesticides have been shown to cause synergism of the toxicity of other chemicals. Amitraz and phosmet may pose some carcinogenic risk. Proper cleaning and disposal of residual pesticides from equipment is important. This is particularly true for coumaphos and crotoxyphos, which can pose moderate to severe hazard of groundwater contamination if not properly handled.

b. Sprays

Chemicals applied as pesticides to animals by sprays include amitraz, chlorpyrifos, coumaphos, lime sulfur, and permethrin. Sprays are applied directly to the animals, but there is some drift into the air and some pesticide that lands on grass, soil, and other surfaces adjacent to the treated animals.

Environmental Fate and Routes of Exposure. The environmental fate of pesticides used in sprays and the route of transport or exposure for given environmental components are presented in Table 8.

Table 8. Environmental Fate of Pesticides Applied by Spray Treatments in VS Programs

Environmental Fate Component	Route of Transport/Exposure
Air	Volatilization and drift
Mixer/loader	Preparation of formulation and placement in spray equipment
Applicator	Exposure to residues while spraying pesticide on animals
Soil/vegetation	Animals shaking or rubbing off residues
	Excretion of residual pesticides by animals
	Cleaning and disposal of residual pesticide contents of spray equipment after treatment of animals
Groundwater	Cleaning and disposal of residual pesticide contents of spray equipment after treatment of animals
Birds (*i.e.*, cattle egret)	Exposure from standing or feeding on arthropods on backs of treated livestock
Nontarget terrestrial invertebrates	Exposure to residual pesticide from treatment or disposal practices

The fate of sprays in the atmosphere can be important to analyze, particularly with volatile chemicals that can drift. Despite adherence to pesticide label instructions, exposures of mixers, loaders, and applicators to pesticide residues must be analyzed. There are several potential routes by which pesticides from spray applications may be transported to soil or vegetation. Residues may be released to soil or vegetation by the treated animal through physical transport or excretion. Residues also may be transported to soil or vegetation from cleaning and disposal procedures. Improper disposal of pesticide can result in contamination of groundwater. The nontarget organisms most likely to be exposed to pesticides from spray treatments are certain species of birds and terrestrial invertebrates. Components of the environment unlikely to pick up residues from spray treatments are not presented.

Potential Hazards. The potential hazards to given environmental components from each pesticide used in spray treatments are presented in Table 9. The hazards posed by spray applications relate primarily to the type of pesticide used. The acute toxicity hazard of coumaphos is moderate. The acute irritation hazard of lime sulfur is considerable for skin, eyes, mucous membranes, and the respiratory tract. Production of hydrogen sulfide gas from degradation of lime sulfur is a noteworthy hazard. Increased toxicity to other chemicals through synergistic effects has been noted with amitraz, chlorpyrifos, coumaphos, and permethrin.

Table 9. Potential Hazards of Pesticides Applied as Spray Treatments in VS Programs

Chemical	Environmental Component	Critical Factors and Potential Hazards
Amitraz	Air	Low vapor pressure: negligible hazard
	Mixer/ loader	Slight to moderate acute toxicity; low absorption and rapid excretion, synergistic effects, borderline Group C/D carcinogen: low acute hazard, slight chronic hazard
	Applicator	Slight to moderate acute toxicity; low absorption and rapid excretion, synergistic effects, borderline Group C/D carcinogen: low acute hazard, slight chronic hazard
	Soil/ vegetation	6 hour half-life on wet soil: negligible hazards from residues spread by animals; slight hazards for improper cleaning or inadequate disposal
	Birds	Very slightly to slightly toxic to birds: negligible hazard for likely exposure routes
	Nontarget terrestrial invertebrates	Selectively toxic to ticks, mites, and hoppers: high hazard to sensitive species exposed; low hazard for most species with proper handling of pesticide
Chlorpyrifos	Air	Relatively low vapor pressure, 2.27 hour half-life: negligible hazard
	Mixer/ loader	Moderate acute toxicity; rapid excretion, synergistic effects: low acute hazard
	Applicator	Moderate acute toxicity; rapid excretion, synergistic effects: low acute hazard

Chemical	Environmental Component	Critical Factors and Potential Hazards
Chlorpyrifos (*continued*)	Soil/ vegetation	Long half-life on soil, rapid half-life on plants: negligible hazards from residues spread by animals; slight hazards for improper cleaning or inadequate disposal
	Birds	Moderate to severe acute toxicity: slight hazard from likely exposure routes
	Nontarget terrestrial invertebrates	Severe acute toxicity to most species: high hazard to sensitive species exposed; slight hazard for most species with proper handling of pesticide
Coumaphos	Air	Very low vapor pressure: negligible hazard
	Mixer/ loader	Moderate to severe acute toxicity; rapid excretion, synergistic effects, mild eye and skin irritation: moderate acute hazard
	Applicator	Moderate to severe acute toxicity; rapid excretion, synergistic effects, mild eye and skin irritation: moderate acute hazard
	Soil/ vegetation	Readily binds to soil organic matter: negligible hazards from residues spread by animals; slight hazards for improper cleaning or inadequate disposal
	Birds	Moderate to severe toxicity: slight hazard from likely exposure routes
	Nontarget terrestrial invertebrates	Moderate to severe toxicity: high hazard to sensitive species exposed; slight hazard for most species with proper handling of pesticide
Lime sulphur	Air	Only potential hazard results from off-gasing of hydrogen sulfide: low hazard expected for well ventilated treatment area
	Mixer/ loader	Primary concerns relate to irritation of eyes, skin, mucous membranes, and lungs; hydrogen sulfide gas: low hazard expected for well ventilated treatment area and proper protective gear
	Applicator	Primary concerns relate to irritation of eyes, skin, mucous membranes, and lungs; hydrogen sulfide gas: low hazard expected for well ventilated treatment area and proper protective gear

Chemical	Environmental Component	Critical Factors and Potential Hazards
Lime Sulphur (*continued*)	Soil/Vegetation	Rapid degradation on soil/vegetation leaving a sulfur residue, may burn plant leaves: negligible hazards from residues spread by animals; slight acute hazards from improper cleaning or inadequate disposal
	Birds	No acute toxicity data: negligible to slight acute hazard most likely for exposure routes
	Nontarget terrestrial invertebrates	Selectively toxic to mites: high hazard to sensitive species exposed, low hazard for most species with proper handling of pesticide
Permethrin	Air	Relatively low vapor pressure: negligible hazard
	Mixer/ loader	Slight acute toxicity; rapid excretion, synergistic effects, mild skin irritant, neurologic effects: negligible to slight acute hazard
	Applicator	Slight acute toxicity; rapid excretion, synergistic effects, mild skin irritant, neurologic effects: negligible to slight acute hazard
	Soil/ vegetation	Maximum soil half-life of 6 weeks, moderate persistence on foliage: negligible hazards from residues spread by animals; slight hazards for improper cleaning or inadequate disposal
	Birds	Very slight acute toxicity: negligible to slight acute hazard
	Nontarget terrestrial invertebrates	Severely toxic to most insects: high hazard to sensitive species exposed, low hazard for most species with proper handling of pesticide

Chronic hazards are limited to some adverse neurologic effects from permethrin and the slight carcinogenic potential of amitraz (6, 8, 9, 13, 15, 17, 19, 21, 22, 29-31, 34, 35, 38, 39, 41, 46-48, 50, 53-55, 57-60, 62-67, 69, 70, 74, 76, 79, 80, 82-88, 90, 92, 94, 95, 97, 98, 99, 107, 108, 110, 112, 115, 116, 120, 121, 123, 126, 128-130, 132-136, 138, 142-145, 148, 158-160, 164, 167, 174, 175, 178-180, 182-184, 187).

c. Premises Treatments

The premises treatments involve direct applications to soil, plants, buildings, bedding areas, and fomites that harbor pests. A Dursban®

(chlorpyrifos) spray formulation is used to treat premises and vehicles. A Sevin® (carbaryl) dust formulation is also used to treat premises.

Environmental Fate and Routes of Exposure. The environmental fate of pesticides used in premises treatments and the route of transport or exposure for given environmental components are presented in Table 10.

Table 10. Environmental Fate of Pesticides Applied as Premises Treatments in VS Programs

Environmental Fate Component	Route of Transport/Exposure
Air	Volatilization and drift
Soil	Direct treatment
Vegetation/bedding areas	Direct treatment
Impervious artificial surfaces and fomites	Direct treatment
Mixer/loader	Preparation of formulation and placement in application equipment
Applicator	Exposure to residues while applying pesticide
Birds	Residue exposure from premises treatments
Reptiles and terrestrial amphibians	Residue exposure from premises treatments
Nontarget terrestrial invertebrates	Residue exposure from premises treatments

The fate of pesticides in the atmosphere is important, particularly with volatile chemicals that drift. Detectable residues of pesticides in soil, vegetation, bedding areas, and fomites are most likely to result from direct treatments. Despite adherence to label instructions, exposures of mixers, loaders, and applicators to pesticide residues need to be analyzed. The nontarget organisms most likely to be exposed to pesticide residues from premises treatments are certain species of birds, some reptiles, some terrestrial amphibians, and terrestrial invertebrates. Components of the environment unlikely to pick up residues from premises treatments are not presented.

Potential Hazards. The potential hazards to given environmental components from each pesticide used in premises treatments are presented in Table 11. The hazards relate to physical and chemical

Table 11. Potential Hazards of Insecticides Applied as Premises Treatments in VS Programs

Chemical	Environmental Component	Critical Factors and Potential Hazards
Chlorpyrifos (spray)	Air	Relatively low vapor pressure, 2.27 hour half-life: negligible hazard
	Soil	Long half-life on soil: low hazards from premises treatment, moderate hazards from improper cleaning or inadequate disposal
	Vegetation and bedding areas	Rapid half-life on plants, low phytotoxicity: negligible hazards from residues spread by animals; slight hazards for improper cleaning or inadequate disposal
	Artificial surfaces and fomites	Vapor pressure, weathering, and photolysis likely to prevent persistence on these surfaces: negligible acute hazard
	Mixer/loader	Moderate acute toxicity; rapid excretion, synergistic effects: low acute hazard
	Applicator	Moderate acute toxicity; rapid excretion, synergistic effects: low acute hazard
	Birds	Moderate to severe acute toxicity: slight to moderate hazard from likely exposure routes
	Reptiles and terrestrial amphibians	Moderate acute toxicity: slight to moderate hazard from likely exposure routes
	Nontarget terrestrial invertebrates	Severe acute toxicity to most species: high hazard to sensitive species exposed; low to moderate hazard for most species with proper handling of pesticide
Carbaryl (dust)	Air	Very low vapor pressure: negligible hazard
	Soil	7 day half-life, little runoff or leaching: negligible hazard from premises treatment, slight hazards from improper cleaning or inadequate disposal

Chemical	Environmental Component	Critical Factors and Potential Hazards
Carbaryl (dust) (*continued*)	Vegetation and bedding areas	3 to 10 day pesticidal half-life on vegetation: negligible hazard from premises treatment, slight hazards from improper cleaning or inadequate disposal
	Artificial surfaces and fomites	15 to 30 hour half-life on inert surfaces: negligible hazard from premises treatment, slight hazards from improper cleaning or inadequate disposal
	Mixer/loader	Moderate acute toxicity; rapid excretion, eye and skin irritant, potential carcinogenic metabolite: slight acute hazard, very slight chronic hazard
	Applicator	Moderate acute toxicity; rapid excretion, eye and skin irritant, potential carcinogenic metabolite: slight acute hazard, very slight chronic hazard
	Birds	Slight acute toxicity: slight acute hazard
	Reptiles and terrestrial amphibians	Slight acute toxicity: slight acute hazard
	Nontarget terrestrial invertebrates	Severely toxic to many insects, ticks, mites, and earthworms; less toxic to spiders: high hazard to sensitive species exposed; low to moderate hazard for most species with proper handling of pesticide

characteristics, toxicity, and environmental fate and transport. The critical factors presented with the potential hazard are factors used in the characterization of hazard as the basis for indicating increased or decreased potential risk of the pesticide as applied by the specific application method.

The hazards posed by premises treatments relate primarily to the pesticide used. Carbaryl is an eye and skin irritant, but poses only slight acute hazards. A potential metabolite of carbaryl has carcinogenic potential. Chlorpyrifos has been shown to increase toxicity of other chemicals through synergistic effects. The premises treatments have greater likelihood of exposures to wildlife than other applications in VS programs. This does not greatly increase the likely slight hazards of carbaryl, which is generally of low toxicity except to the terrestrial invertebrates. Hazards from applications of chlorpyrifos, however, may pose moderate hazards for some species of wildlife, particularly birds and terrestrial invertebrates on the premises. The

hazards to exposed insects from both pesticides are expected to be high (2, 3, 6, 14, 16, 20, 27, 28, 36-38, 41, 42, 45, 47-49, 51, 55, 60, 61, 64, 65, 67, 68, 71-73, 77, 78, 81, 84-86, 93, 100, 106, 107, 114-116, 118-120, 129, 134, 136, 139, 146, 151-153, 161, 163, 166-170, 178, 179, 185, 186, 188).

d. Dusts

Carbaryl (Sevin®) is applied in a pesticide dust formulation to animals. Dusts applied directly to animals are more likely to drift than sprays because of the generally smaller particle size of dusts. This drift may result in some residues on grass, soil, and other surfaces adjacent to treated animals.

Environmental Fate and Routes of Exposure. The environmental fate of carbaryl used in dust treatments and the route of transport or exposure for given environmental components are presented in Table 12.

Table 12. Environmental Fate of Carbaryl Applied as Dust Treatments in VS Programs

Environmental Fate Component	Route of Transport/Exposure
Air	Volatilization and drift
Mixer/loader	Preparation of formulation and placement in dusting equipment
Applicator	Exposure to residues while dusting pesticide on animals
Soil/vegetation	Animals shaking or rubbing off residues
	Excretion of residual pesticides by animals
	Cleaning and disposal of residual pesticide contents of dusting equipment after treatment of animals
Groundwater	Cleaning and disposal of residual pesticide contents of dusting equipment after treatment of animals
Birds	Exposure to residual pesticide from treatment or disposal practices

Environmental Fate Component	Route of Transport/Exposure
Nontarget terrestrial invertebrates	Exposure to residual pesticide from treatment or disposal practices

The fate of pesticides in the atmosphere can be important to analyze, particularly with volatile chemicals that drift. Despirte adherence to label instructions, exposure of mixers, loaders, and applicators to pesticide residues must be analyzed. There are several potential routes by which pesticides from dust applications may be transported to soil or vegetation. Residues of the pesticide may be released to soil or vegetation by the treated animal through physical transport or excretion. Residues may be transported to soil or vegetation from cleaning and disposal procedures. Improper disposal of pesticide can result in contamination of groundwater. The nontarget organisms most likely to be exposed to pesticide residues from dust treatments are certain species of birds and terrestrial invertebrates. The proper handling of pesticide and proper safety precautions can minimize most potential exposures. Components of the environment unlikely to pick up residues from dust treatments are not presented.

Potential Hazards. The potential hazards to given environmental components from dust treatments are presented in Table 13. The hazards posed by carbaryl dust applications to animals relate primarily to human health issues. The irritation to eyes and skin from carbaryl may be prevented with proper protective clothing. The slight potential for carbaryl to be metabolized to the carcinogenic metabolite also should be considered. The primary organisms affected by dust treatments are the target pests of the treated animals (2, 5, 11, 20, 26-28, 36-38, 40, 45, 46, 49-53, 60, 61, 68, 70-72, 81, 93, 111, 114, 117-120, 139, 141, 145, 146, 150, 151, 161, 163, 166, 168-170, 186, 188, 191).

e. Washes

Lime sulfur is applied as a pesticide wash to animals. The residual wash water from a treatment contains pesticide residues. It must be collected and disposed of properly. This is of particular concern in foreign countries where regulations regarding disposal of the wash water are not as stringent as the requirements of the USEPA.

Environmental Fate and Routes of Exposure. The environmental fate of lime sulfur used in wash treatments and the route of transport or exposure for given environmental components are presented in

Table 14. There are several potential routes by which pesticides from wash treatments may be transported to soil or vegetation. Residues of the pesticide may be released to soil or vegetation by the treated animal through physical transport or excretion. Residues may be transported to soil or vegetation from cleaning and disposal procedures. Improper disposal of pesticide can result in contamination of groundwater. The nontarget organisms most likely to be exposed to pesticide residues from wash treatments are certain species of birds and terrestrial invertebrates. Proper safety precautions and the proper handling of

Table 13. Potential Hazards of Carbaryl Applied as Dust Treatments in VS Programs

Environmental Component	Critical Factors and Potential Hazards
Air	Very low vapor pressure: negligible hazard
Mixer/loader	Moderate acute toxicity; rapid excretion, eye and skin irritant, potential carcinogenic metabolite: slight acute hazard, very slight chronic hazard
Applicator	Moderate acute toxicity; rapid excretion, eye and skin irritant, potential carcinogenic metabolite: slight acute hazard, very slight chronic hazard
Soil/vegetation	7 day half-life on soil, little runoff or leaching, 3 to 10 day pesticidal half-life on vegetation: negligible hazards from residues spread by animals; slight hazards for improper cleaning or inadequate disposal
Birds	Slight acute toxicity: negligible acute hazard
Nontarget terrestrial invertebrates	Severely toxic to many insects, ticks, mites, and earthworms; less toxic to spiders: high hazard to sensitive species exposed; low to moderate hazard for most species with proper handling of pesticide

pesticide can minimize most potential exposures. Components of the environment unlikely to pick up residues from wash treatments are not presented.

Table 14. Environmental Fate of Lime Sulfur Applied as Wash Treatments in VS Programs

Environmental Fate Component	Route of Transport/Exposure
Air	Volatilization and drift
Mixer/loader	Preparation of formulation and placement in application equipment
Applicator	Exposure to residues while applying wash to animals
Soil/vegetation	Animals shaking or rubbing off residues
	Excretion of residual pesticides by animals
	Cleaning and disposal of residual pesticide contents of wash equipment after treatment of animals
Groundwater	Cleaning and disposal of residual pesticide contents of wash equipment after treatment of animals
Birds (*i.e.*, cattle egrets)	Residues from standing or feeding on arthropods on backs of treated livestock
Nontarget terrestrial invertebrates	Exposure to residual pesticide from treatment or disposal practices

Potential Hazards. The potential hazards to given environmental components from wash treatments of lime sulphur are presented in Table 15. The hazards posed by lime sulfur wash applications relate primarily to human health. The release of hydrogen sulfide gas from decomposing lime sulfur can cause irritation and burning. The irritation of eyes, skin, mucous membranes, and respiratory tract can be prevented with proper protective gear. The primary organisms affected by wash treatments are the target pests of the treated animals.

Table 15. Potential Hazards of Lime Sulfur Applied as Wash Treatments in VS Programs

Environmental Component	Critical Factors and Potential Hazards
Air	Only potential hazard results from off-gasing of hydrogen sulfide: low hazard expected for well-ventilated treatment area
Mixer/loader	Primary concerns relate to irritation of eyes, skin, mucous membranes, and lungs; hydrogen sulfide gas: low hazard expected for well-ventilated treatment area and proper protective gear
Applicator	Primary concerns relate to irritation of eyes, skin, mucous membranes, and lungs; hydrogen sulfide gas: low hazard expected for well-ventilated treatment area and proper protective gear
Soil/vegetation	Rapid degradation on soil and vegetation leaves a sulfur residue, may burn plant leaves: negligible hazards from residues spread by animals; slight acute hazards from improper cleaning or inadequate disposal
Groundwater	Minimal leaching of residues of calcium and sulfur anticipated: negligible to slight hazard
Birds	No acute toxicity data: negligible to slight acute hazard for exposure routes
Nontarget terrestrial invertebrates	Selectively toxic to mites: high hazard to sensitive species exposed, low hazard for most species with proper handling of pesticide

f. Topical Treatments

Permethrin (Atroban®) is applied topically to animals by wipe-ons or nasal applications. Topical applications to animals pose less environmental hazards caused by direct application to the skin or nasal area of the animals. There is almost no drift, but there will be some volatilization of permethrin. These applications should not result in any direct movement of pesticide residues other than on the animals treated and in the air through volatilization. The applicators used to apply the pesticide must be properly cleaned and any contaminated application material handled properly for disposal as a pesticide waste.

Environmental Fate and Routes of Exposure. The environmental fate of permethrin used in topical treatments and the route of transport or exposure for given environmental components are presented in Table 16. There are several potential routes by which pesticides from topical treatments may be transported to soil or vegetation, but residues of the pesticide are most likely to be transported to soil or vegetation by the treated animal through physical transport or excretion. The nontarget organisms most likely to be exposed to pesticide residues from wipe-on treatments are certain species of birds and terrestrial invertebrates. The proper handling of pesticide and proper safety precautions can minimize most potential exposures. Components of the environment unlikely to pick up residues from topical treatments are not presented.

Table 16. Environmental Fate of Permethrin Applied by Topical Treatments in VS Programs

Application	Environmental Fate Component	Route of Transport/Exposure
Wipe-ons	Air	Volatilization
	Applicator	Exposure to residues while applying pesticide
	Soil/vegetation	Animal rubbing off residues Excretion of residual pesticide by animals
	Birds	Exposure to residual pesticide from treatment or disposal practices
	Nontarget terrestrial invertebrates	Exposure to residual pesticide from treatment or disposal practices
Nasal	Applicator	Exposure to residues while applying pesticide
	Soil/vegetation	Excretion of residual pesticide by animals

Potential Hazards. The potential hazards to given environmental components from topical treatments of permethrin are presented in Table 17. The hazards posed by topical applications of permethrin relate primarily to human health. Permethrin can increase the toxicity

of some chemicals through synergistic action. There is some mild skin irritation possible and neurologic effects can result from chronic exposures. The primary organisms affected by topical treatments are the target pests of the treated animals (30, 34, 38, 46, 53, 55, 56, 68, 71, 74, 76, 77, 79, 80, 82, 83, 88, 104, 110, 112, 125, 126, 138, 144, 154, 181).

Table 17. Potential Hazards of Permethrin Applied by Topical Treatments in VS Programs

Application	Environmental Component	Critical Factors and Potential Hazards
Wipe-ons	Air	Relatively low vapor pressure: negligible hazard
	Applicator	Slight acute toxicity; rapid excretion, synergistic effects, mild skin irritant, neurologic effects: negligible to slight acute hazard
	Soil/vegetation	Negligible hazards from low residues spread by animals
	Bird	Very slight acute toxicity: negligible acute hazard
	Nontarget terrestrial invertebrate	Severely toxic to most insects: high hazard to sensitive species exposed; low hazard for most species with proper handling of pesticide
Nasal	Applicator	Slight acute toxicity; rapid excretion, synergistic effects, mild skin irritant, neurologic effects: negligible to slight acute hazard
	Soil/vegetation	Negligible hazards from low residues spread by animals

g. Systemic Treatments

Ivermectin (Ivomec®) is applied as a systemic pesticide to animals through injection or oral applications. These treatments are placed within the body of the animal, so their residues are restricted to the animal until metabolism or excretion occurs.

Environmental Fate and Routes of Exposure. The environmental fate of ivermectin used in systemic treatments and the route of transport or exposure for given environmental components are presented in Table 18. The method of the pesticide application determines which environmental fate components need to be considered. The systemic treatments are placed inside the animal's body, which limits the exposed environmental components more than the other treatments. Despite adherence to pesticide label instructions, exposures of the applicators to pesticide residues must be analyzed. Residues of the pesticide are most likely to be transported to soil or vegetation by the treated animal through excretion. The nontarget organisms most likely to be exposed to pesticide residues from systemic treatments are certain species of birds and terrestrial invertebrates. The proper handling of pesticide and proper safety precautions can minimize most potential exposures. Components of the environment unlikely to pick up residues from systemic treatments are not presented.

Table 18. Environmental Fate of Ivermectin Applied as Systemic Treatments in VS Programs

Environmental Fate Component	Route of Transport/Exposure
Applicator	Exposure to residues while applying pesticide
Soil/vegetation	Excretion of residual pesticide by animals
Birds	Exposure to residual pesticide from treatment or disposal practices
Nontarget terrestrial invertebrates	Exposure to residual pesticide from treatment or disposal practices

Potential Hazards. The potential hazards to given environmental components from systemic treatments of ivermectin are presented in Table 19. The hazards posed by systemic applications of ivermectin relate primarily to immunotoxic responses of applicators. The primary organisms affected by systemic treatments are the target pests of the treated animals (17, 23-25, 32, 55, 56, 90, 103, 113, 129, 140, 189).

Table 19. Potential Hazards of Ivermectin Applied as Systemic Treatments in VS Programs

Environmental Component	Critical Factors and Potential Hazards
Applicator	Severely toxic; minor immunotoxic responses: low acute hazard with proper protective gear to avoid exposure
Soil/vegetation	Binds readily to organic matter and is inactivated: low hazard
Birds	No data located, but probably severely toxic to birds: reactive nature of compound and potential exposure routes result in slight to low acute hazard
Nontarget terrestrial invertebrates	Selectively toxic to mites: high hazard to sensitive species exposed; low hazard for most species with proper handling of pesticide

3. Disinfectants

Chemicals applied as disinfectants include calcium hypochlorite, chlorinated lime, cresylic disinfectants, formaldehyde, hydrochloric acid, iodine, phenol, sodium bicarbonate, sodium bifluoride, sodium carbonate, sodium hydroxide, sodium hypochlorite, sodium ortho-phenylphenate, sodium silicate, and 1-Stroke Environ®. Disinfectants are generally applied directly to the surface or material being treated until the contaminated surface is covered or immersed.

Environmental Fate and Routes of Exposure. The disinfectants are generally applied indoors or in secure locations to contaminated surfaces or materials. Volatilization to the air is the only route of transport for these compounds during disinfection. The evaporation or volatilization of these chemicals during disinfection results in considerable concentrations in the air, some of human health concern. Potential exposures are possible to the applicator and any others that enter the room because of these volatilized chemicals in the air. Most of these chemicals are highly reactive and residues only remain on inert or unreactive surfaces. Disposal of residual disinfectant is of concern in some foreign countries where regulations regarding disposal of disinfectants are not as stringent as the requirements of the USEPA. Proper disposal prevents concern for exposure of other environmental components.

Potential Hazards. The potential hazardous conditions in disinfection that cause poor air quality can be prevented by adequate ventilation or proper respiratory apparatus and protective clothing when entering contaminated air spaces. Proper cleaning of treated surfaces/materials

and proper disposal of residual disinfectant prevents other potential hazards. The primary hazards are to the applicators of the disinfectant. The hazards to applicators are summarized in Table 20. The primary hazard of most of the disinfectants is burning or irritation of skin, eyes, mucous membranes, and respiratory tract. Many pose high acute irritation hazard. Cresylic disinfectant, phenol, and sodium hydroxide pose moderate acute toxicity hazard. Cresylic disinfectant has been shown to increase toxicity of other compounds through synergistic effects. Phenol, sodium ortho-phenyl phenate, and 1-Stroke Environ® have been found to be immunosuppressive. Cresylic disinfectants and formaldehyde are known skin sensitizers. Formaldehyde is also a potent allergen. Hydrochloric acid, sodium ortho-phenyl phenate, and 1-Stroke Environ® have been found to cause kidney damage. Sodium ortho-phenyl phenate and 1-Stroke Environ® have been found to cause liver damage. Phenol and sodium bifluoride can cause suppression of the central nervous system. Sodium bifluoride has been found to cause blood disorders. Repeated exposure to hydrochloric acid has been associated with adverse reproductive effects. Although iodine has been found to have potential teratogenic and oncogenic effects at high exposures, it also is a mineral that is required to meet the recommended daily dietary allowances. Proper protective gear prevents high exposures to iodine and the chronic hazards of iodine should not occur for any program disinfections. Cresylic disinfectant and formaldehyde have been shown to be carcinogenic. Cresylic disinfectant has been shown to be mutagenic. Although the potential for hazardous effects from these agents are considerable, use of proper protective gear and safety precautions minimizes the risks to applicators.

Table 20. Potential Hazards to Applicators of Disinfectants Used in VS Programs

Disinfectant	Magnitude of Hazard	Recommended Protective Gear	Potential Risk When Using Protective Gear
Calcium hypochlorite	Very slight acute toxicity; burns skin, eyes, and respiratory tract: moderate acute hazard	Impervious clothing and gloves, safety goggles, and face shield	Protective gear should minimize acute risks; respirator may be needed in situations of limited ventilation

Disinfectant	Magnitude of Hazard	Recommended Protective Gear	Potential Risk When Using Protective Gear
Chlorinated lime	Slight toxicity; extremely irritating to skin, eyes, mucous membranes, and respiratory tract: high acute hazard	Neoprene gloves, safety goggles, impervious clothing, adequate ventilation, dust mask or respirator	Slight to low potential risk depending on the adequacy of the protective gear to prevent exposure
Cresylic disinfectant	Moderate toxicity; burns eyes and skin, skin sensitizer, synergistic effects, carcinogenic risk, mutagenic risk: high acute hazard, moderate chronic hazard	Impervious clothing and gloves, safety goggles and face shield, adequate ventilation, dust mask or respirator	Protective gear that minimizes exposure can adequately protect against acute risks; chronic risks more difficult to minimize
Formaldehyde	Slight acute toxicity; irritating to skin, eyes, mucous membranes, and respiratory tract; skin sensitizer and potent allergen, Category B1 - probable human carcinogen: high acute hazard, moderate chronic hazard	Impervious clothing and gloves, safety goggles and face shield, adequate ventilation, dust mask or respirator	Protective gear that minimizes exposure can adequately protect against acute risks; chronic risks more difficult to minimize (formaldehyde applications in programs very limited)
Hydrochloric acid	Burns eyes, skin, mucous membranes, and respiratory tract; kidney damage; adverse reproductive effects: high acute hazard, moderate chronic hazard	Impervious clothing and gloves, safety goggles, face shield, respirator	Protective gear that minimizes exposure can adequately protect against acute risks; chronic risks more difficult to minimize

Disinfectant	Magnitude of Hazard	Recommended Protective Gear	Potential Risk When Using Protective Gear
Iodine	Burns eyes, skin, mucous membranes, and respiratory tract; oncogenic and teratogenic potential: moderate acute hazard, slight chronic hazard	Impervious clothing and gloves, safety goggles, and face shield, adequate ventilation to prevent respiratory tract irritation	Protective gear that minimizes exposure can adequately protect against acute risks; chronic risks unlikely for potential exposures
Phenol	Moderate acute toxicity; burns skin, eyes, mucous membranes, and respiratory tract; suppresses immune and central nervous system: high acute hazard, moderate chronic hazard	Impervious clothing and gloves, safety goggles, face shield, and respirator	Protective gear that minimizes exposure can adequately protect against acute risks; chronic risks more difficult to minimize
Sodium bicarbonate	Slight acute toxicity; irritant to eyes, skin, and respiratory tract: slight acute hazard	Impervious gloves and safety goggles	Protective gear should minimize risks adequately
Sodium bifluoride	Irritant to skin, eyes, and respiratory tract; blood disorders, adverse effects to central nervous system: moderate hazard	Impervious gloves, dust mask, and safety goggles	Protective gear should adequately minimize acute risks; respirator may be needed in situations of limited ventilation and to prevent chronic effects
Sodium carbonate	Very slight to slight acute toxicity; burns skin, eyes, mucous membranes, and respiratory tract: moderate acute hazard	Impervious gloves, safety goggles, and dust mask	Protective gear should minimize acute risks adequately

Disinfectant	Magnitude of Hazard	Recommended Protective Gear	Potential Risk When Using Protective Gear
Sodium hydroxide	Moderate acute toxicity; burns skin, eyes, mucous membranes, and respiratory tract; chronic lung damage: high acute hazard	Impervious clothing and gloves, safety goggles, face shield, and respirator	Protective gear should minimize acute risks adequately
Sodium hypochlorite	Very slight acute toxicity; burns skin, eyes, and respiratory tract: moderate acute hazard	Impervious clothing and gloves, safety goggles, and face shield	Protective gear should minimize acute risks; respirator may be needed in situations of limited ventilation
Sodium ortho-phenyl phenate	Slight acute toxicity; burns skin, eyes, mucous membranes, and respiratory tract; depresses immune system; damages liver, kidney, and lungs: high acute hazard, moderate chronic hazard	Impervious clothing and gloves, safety goggles, face shield, and respirator	Protective gear should adequately minimize acute risks; chronic risks more difficult to minimize
Sodium silicate	Slight acute toxicity; may burn eyes, skin, and respiratory tract: moderate acute hazard	Impervious clothing and gloves, safety goggles, and face shield	Protective gear should minimize acute risks; respirator may be needed in situations of limited ventilation

Disinfectant	Magnitude of Hazard	Recommended Protective Gear	Potential Risk When Using Protective Gear
1-Stroke Environ®	Components of mixture have slight to moderate acute toxicity; burns skin, eyes, mucous membranes, and respiratory tract; depresses immune system; damages liver, kidney, and lungs: high acute hazard, moderate chronic hazard	Impervious clothing and gloves, safety goggles, face shield, and respirator	Protective gear should adequately minimize acute risks; chronic risks more difficult to minimize

Applicators of disinfectants should wear proper protective gear to prevent adverse health effects. Impervious clothing, including impervious gloves, should be worn. Safety goggles are required and a face shield also should be used. Dust masks may be sufficient for some disinfectants, but respirators are preferred. Protective gear can adequately protect applicators from adverse acute hazards, but chronic and systemic effects of some disinfectants may be difficult to protect against. Adequate protection from the hazards of repeated use of cresylic disinfectants, formaldehyde, hydrochloric acid, phenol, sodium ortho-phenyl phenate, and 1-Stroke Environ® is of particular concern. Impervious clothing, gloves, safety goggles, face shield, and self-contained breathing apparatus may be the only effective protective gear under some circumstances (4, 7, 17, 21, 33, 43, 46, 50, 53, 56-59, 71, 75, 89-91, 96, 101, 108, 112, 121-124, 126, 130, 133, 138, 143, 147, 149, 155, 157, 162, 172, 176, 177, 183, 190).

4. Mitigation

Chemical use in VS programs is restricted to the use of pesticides and disinfectants registered for use in the United States. Potential resources impacted by chemical applications include soil, water, air, human health, wildlife, vegetation, solid waste, and cultural resources. All applications of chemicals are applied in compliance with the label instructions. Label instructions are the basis for all legal applications of chemicals and require specific safety equipment and procedures to mitigate potential adverse effects. All chemical labels and application procedures adhere to requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA, U.S.C. §§ 136-136y). VS programs will comply with label instructions and FIFRA requirements. This compliance will minimize the possibility of adverse effects, thus mitigating effects of program activities.

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D. Import–Export Program

1. Program Mission

The mission of the APHIS VS Import-Export Program is to prevent the introduction and dissemination of foreign animal diseases and pests into the livestock and poultry populations in the United States and to assure the export of healthy disease-free animals to foreign countries. The regulations applicable to import and export of animals, including animal semen and animal embryos, apply primarily to domestic livestock and poultry. However, the import of birds and many zoological animals also is included. The program staff constantly reviews statutes and regulations, develops import-export regulations and protocols, and maintains an awareness of the state of the art in testing for, treatment of, and control and eradication of animal diseases and pests. Import-export staff have been actively involved with other sections of APHIS in the development of a formal risk assessment system to analyze the level of disease risk associated with the importation of animals and animal products from various countries. The monitoring of disease outbreaks through information provided by the International Office of Epizootics, agriculture attaches, and other officials throughout the world assists the import-export staff in determining what diseases and pests exist in animals in different countries. Specific science-based regulations and strict enforcement provide the first line of defense against the introduction of animal diseases and pests.

The U.S. livestock and poultry populations are free of many of the most devastating diseases found in many other parts of the world. Animals and products originating in the United States are, therefore, allowed entry into most countries of the world. The worldwide marketability of U.S. animals and products is in large measure due to sound import policies that protect the Nation's animal health.

2. Program Structure

The Import-Export Program is divided into two sections, one for the regulation of live animals and the other for the regulation of animal products. The section responsible for regulating live animals is further divided into three branches: Export Animal and Avian, Import Animal, and Avian Import. The products section is divided into Organisms and Vectors, Meat, and Animal Products and Export branches.

3. Border Stations

Mexican and Canadian animals and animal products enter the United States only at designated Mexican/U.S. border stations and Canadian/ U.S. border stations, respectively. They must comply with health related regulations and requirements to enter. Accompanying documentation includes an import permit and a health certificate issued

by approved veterinarians in the country of origin. Most of the testing requirements and treatments are specified by regulation in 9 CFR Part 92.

4. Import–Export General Protocol

a. Live Animal Imports

The provisions of the Import Program are designed to protect livestock and poultry populations in the United States against the introduction of foreign animal diseases and pests through enforcement of regulations. These import regulations establish the requirements for importation. The import permit will specify the appropriate port of entry and animal import center for the arrival of the shipments. All animal imports must be accompanied by health certification papers provided by veterinary officials of the country of origin. These health certification papers verify that the animals have been quarantined (for ratites that they are pen-raised), inspected as required, and appropriately tested prior to departure from the country of origin. Generally, all vaccinations, treatments, and similar health related activities are conducted in the country of origin. The requirements for testing and certification vary according to the diseases and pests that are endemic in the country of origin and the species to be imported. VS personnel at ports and borders enforce animal import regulations.

When quarantine is required, imported animals arriving in the United States at ocean ports and airports must be consigned directly to the quarantine facility where additional inspection and testing is conducted. While quarantined at the U.S. facility, the animals are thoroughly inspected and tested by VS veterinarians. If the animals are found to be healthy and free of disease, they are released to the importer, or in the case of smuggled endangered or threatened birds, sold or auctioned. If rejected, they may be destroyed, returned to the country of origin, or shipped to any other country that will accept them. Smuggled, endangered, or threatened birds, that have been exposed to a disease, remain in permanent quarantine.

The quarantine facility selected is the one considered appropriate for the level of risk associated with the particular animal and its country of origin. For example, shipments of cloven-footed animals from countries with known disease risk, such as those not recognized as free of FMD and rinderpest, are allowed entry into the United States only through the Harry S Truman Animal Import Center (HSTAIC). HSTAIC is a maximum security facility located on Fleming Key, Florida. This quarantine is preceded by quarantine and testing at a USDA-approved facility in the country of origin. At HSTAIC, the imported animals are placed in contact with sentinel cattle and pigs from the United States. Imported birds, other than ratites, may be quarantined in USDA-approved and supervised, privately owned quarantine facilities. Ratites

(other than ostriches) must be quarantined at the New York, Miami, or Hawaii Animal Import Center where specially trained personnel are employed. Ostriches are quarantined at the animal import centers at New York and Miami. Ratites may need to be treated with pesticides to ensure they are free of ectoparasites.

b. Embryos and Semen.Imports

Embryos and semen of animals from countries that are not affected by FMD or rinderpest can be imported into the United States with a permit and health certificate. The required health testing is conducted in the country of origin. Permits are required for all germplasm importations except those of semen presented at Canadian land border stations. Specific information for the import of embryos and semen may be found in 9 CFR Part 98.

Embryos from cattle in countries affected by FMD or rinderpest can be imported into the Unites States under certain conditions. The collection of the embryos must be conducted by an official veterinarian from the country of origin. The tests from the donor and embryos, along with the wash fluids, must be performed by the Foreign Animal Disease Diagnostic Laboratory (FADDL) at Plum Island, New York. VS has drafted regulation changes to allow embryos of other ruminants and swine to be imported into the United States from countries affected with FMD or rinderpest under conditions similar to those of cattle embryos.

Semen from ruminants and swine in countries affected with FMD or rinderpest can be imported into the United States if collected under the supervision of a USDA veterinarian, and all required laboratory tests are conducted by the FADDL.

c. Hatching Eggs.Imports

Hatching eggs are quarantined at private quarantine facilities upon arrival in the United States. No imports are allowed from countries that have VVND. The import permit accompanying such eggs certifies the flocks producing the hatching eggs were tested and found free of *Salmonella enteritidis* phage-type 4, adenovirus 127, and turkey rhinotracheitis virus (swollen head). The quarantine period will be no less than 30 days after the last egg is hatched.

d. Zoological Imports

Ratites and other birds imported into the United States for display at zoological institutions must be accompanied by a permit and health certificate specifying there is no evidence of or exposure to communicable diseases of poultry. An additional requirement for

ratites is the treatment with pesticides for ectoparasites. They must have been treated at least 3 days but no more than 14 days before shipment. Upon entering a quarantine facility in the United States, they are further inspected, tested, and treated to ensure they are disease free.

Wild ruminants and wild swine that originate in countries in which FMD and rinderpest exist may be imported into the United States only under the conditions specified in the VS regulations. All animals first must be quarantined in an APHIS-approved preembarkation facility outside of the United States. Sentinel pigs are exposed to wild swine in the preembarkation quarantine facility in the exporting country. The quarantine period must be a minimum of 60 days while the animals are tested twice for any exotic diseases of concern. Both tests must be negative. Samples collected for the first test preferably should be within the first 7 to 10 days of the qualifying period, and the second collection is to be taken at least 30 days after the first collection and preferably within 30 to 40 days. Only test results from samples sent to and tested at the National Veterinary Services Laboratory in Ames, Iowa, or the FADDL are used to satisfy entry requirements. Samples must be shipped under a permit issued by USDA APHIS VS Import Animal staff. All such animals entering the United States will be quarantined for an additional 30 days minimum at the New York Animal Import Center where all tests will be repeated. The animals in this category can only be released as permanently restricted post-entry quarantine animals to specifically approved zoos as listed in VS Memorandum No. 591.7.

e. Live Animal Export

The VS Export Program is responsible for promoting U.S. livestock exports and assuring the health of such livestock. While a country's import health requirements vary, in general, all animals to be exported are inspected within 30 days prior to the date of movement to the port of embarkation. At the port of embarkation a final inspection is made within 24 hours of shipment by an APHIS veterinarian to ensure the

animals are free of clinical evidence of communicable disease and ectoparasites or exposure thereto. The animals to be exported must be accompanied by a health certificate signed by a USDA-accredited veterinarian and endorsed by an APHIS veterinarian in the State of origin. The health certificate must include the results of all tests performed. Animals are not allowed to enter isolation at the U.S. port of embarkation without health certification papers endorsed by VS.

Specific information regarding inspection and the handling of livestock for exportation, including testing, cleaning, conveyance disinfection, and export facilities and ports are covered in 9 CFR Part 91. At the port of final inspection, the animals are held for at least 5 hours for a careful visual inspection, feeding, watering, and rest. Feed and water are not required at the port of embarkation if animals arrive at their destination within 36 hours of embarkation and if adequate feed and water are provided by the shipper. After careful inspection, the APHIS veterinarian issues a certificate that the animals are sound, healthy, and free of evidence of communicable disease. Every effort is made to cooperate with the veterinary services of the receiving country to assure that the animals exported from the United States meet their health requirements.

f. Animal Products Importation

Introduction. Plant Protection and Quarantine (PPQ), a separate program within APHIS, has the responsibility for the enforcement of regulations regarding the importation of certain animal products and by-products at U.S. ports of entry.

Edible Products. Currently fresh, chilled, and frozen meats, and any fresh milk from any country where FMD and rinderpest is found is prohibited from importation into the United States. Comparable restrictions apply to fresh, chilled, or frozen pork from countries affected with hog cholera, African swine fever, and swine vesicular disease, and poultry meat from countries affected by VVND. This prohibition is not only imposed on commercial shipments of meats but extends to food in traveler's baggage, international carriers, and mail shipments.

Meats can be imported from certain countries if they are from approved slaughterhouses and processed by prescribed methods known to eliminate disease organisms. Approved methods usually involve heat treatment, canning, drying, or curing. The prescribed method used to process the meat is dependent on the diseases present. In every case, APHIS requires veterinary officials of the country of origin to certify that the required methods were followed. Samples from import shipments may be inspected and tested by APHIS. Processed meat shipments that fail APHIS standards are refused entry. An example of

such a process is the requirement that all bones, nerve tissue, and lymphatic tissue be removed from beef products imported into the United States from countries where BSE is known to exist.

Most meat and animal products arriving at U.S. ports without proper documentation and originating from countries affected with foreign animal diseases are usually refused entry into the United States. Milk and milk products from such countries can enter the United States under permit or be consigned to an approved establishment for further processing.

Restricted Products. Some animal products, which APHIS VS personnel cannot ensure to be safe if processed in the country of origin, may be imported into the United States for treatment at USDA- approved facilities. These products are permitted to be imported as "restricted" items under special conditions specified by USDA. They are placed under U.S. Government seals at the port of entry, shipped directly to a USDA-approved plant or warehouse, and processed by methods prescribed by USDA before being released into interstate commerce. Some restricted products may be distributed only to qualified users. Some materials enter the United States under a USDA permit which restricts the use of such products. Usually these products are not permitted to be used in circumstances that would result in exposure to domestic livestock or poultry.

Hides and Trophies. Hides and skins from animals that may be infected with exotic pathogens cannot be imported into the United States unless treated in a manner that will destroy the pathogens or be consigned to an approved establishment. Provisions also are made for the importation of hunting trophies, which require these items to be received only by a taxidermist approved by VS to process these restricted materials. The process used by the taxidermist at the approved taxidermist establishment will inactivate all pathogens of concern.

Glands and Other Animal Tissues. Glands and other animal tissues are imported for use in pharmaceutical, biological, and medical preparations. Glands and other animal tissues from ruminants or swine from countries affected with exotic animal diseases are only allowed entry when specified conditions have been met. The restriction on such imports depends on the animal disease status of the country of origin and the type of treatment required to inactivate the pathogen.

Waste Material from Airlines and Ships. In the absence of compliance agreements, regulated garbage is removed from a means of conveyance and unloaded in tight, leak-proof receptacles under the direction of an

APHIS inspector to an approved facility for incineration, sterilization, or grinding into an approved sewage system. This is enforced by APHIS PPQ inspectors at U.S. ports of entry.

Organisms and Vectors. Regulatory efforts related to the importation and transport of organisms and vectors responsible for causing disease have not resulted in any adverse environmental impact since the program was initiated over 50 years ago. All import applications are carefully screened to determine if the requested materials can be safely imported and transported without the risk of exposing the U.S. livestock and poultry populations to infectious diseases. Applications for which the level of risk can be characterized as acceptable (that may involve mitigation) are approved. Most of these importation requests are for research.

Some of the procedures used to ensure that organisms and vectors are used safely and are not released into the environment include:

(1) Some organisms, such as the viruses, that cause African swine fever, rinderpest, FMD, swine vesicular disease, and African horse sickness, are permitted to be used only at the USDA FADDL high security facility. Other highly pathogenic organisms are authorized only at high security facilities such as the Centers of Disease Control in Atlanta, Georgia, the U.S. Department of the Army facility at Fort Detrick, Maryland, and USDA facilities.

(2) APHIS personnel often inspect the laboratory facilities of applicants for permits in order to determine if the facility has the security to contain the organism or vector being requested. Facilities which do not meet USDA requirements are not authorized to obtain or work with specific organisms.

(3) The country of origin and the facility from which the organisms are to be obtained are evaluated in order to determine what pathogens are being utilized in the facility and the animal diseases present in the country from which the organisms are obtained.

(4) The credentials of the person who is requesting the permit are evaluated prior to being issued a permit. Applicants must be qualified to handle the materials or their request will be denied.

(5) APHIS also evaluates the type of studies the applicants intend to conduct with the permitted materials. In most cases, work with permitted materials is limited to *in vitro* studies, and exposure of animals or birds to the materials is not authorized.

(6) Distribution of the organisms or vectors which have been obtained under a USDA permit is only authorized by prior written permission from APHIS.

(7) Following completion of their studies, permittees are often required to destroy any imported organisms and vectors and inform APHIS of their actions in writing.

(8) APHIS personnel often make unannounced inspections of the permittee's facilities in order to determine if the restrictions on the permits for organisms and vectors are being followed.

(9) In order to ensure that imported organisms and vectors are not contaminated with other pathogens, permittees are often required to have the materials safety tested at FADDL before entry into the United States.

(10) Under certain conditions, applicants are authorized to conduct studies of significant scientific value at the FADDL when APHIS considers the studies to be of too great a risk to be conducted on the mainland.

By closely monitoring scientific journals and other media where animal disease research results are published, APHIS personnel identify research involving restricted items. If a records review does not disclose the proper permits for the research organisms, enforcement activities are initiated.

g. Mitigation

The resources/issues identified as being affected by the Import-Export Program are human health, wildlife, and animal welfare. The Import/Export Program basically is a mitigation program. Implementation of the regulations minimizes the possibility that diseases and pests will be imported into or exported out of the United States.

Human Health. The human health issue centers around the possibility of people contracting diseases from animals being imported into the United States. Compliance with the regulations would minimize this possibility. All animals imported into the United States must have a health certificate, which includes the results of all testing for the presence of diseases and pests, prior to entrance. Then once the animals enter the United States, the majority are sent directly to animal import centers where they are quarantined and retested. The personnel dealing with the animals are professional animal caretakers, animal health technicians, or veterinarians that have been trained in

the proper handling procedures. All of these precautions will minimize any effects to human health.

Wildlife. The possible impacts to wildlife are similar to that of human health, the possibility of wildlife contracting a foreign animal disease. Again, the regulations are designed to minimize the possibility of diseases and pests entering the United States. With the testing of the animals in the country of origin for the presence of diseases and pests to the retesting of the animals in the import centers, the possibility of the introduction of a disease or pest into the United States is minimized. All of the testing is completed prior to releasing the animals to the importer.

Animal Welfare. Only APHIS VS personnel, either veterinarians or animal health technicians, who are specially trained to handle animals (or commercial people working under the supervision of APHIS VS personnel) will be at the ports of entry and the animal import centers. Any care or treatment of animals will be accomplished in a humane manner.

E. Vaccination Programs

1. Introduction

VS sometimes uses vaccines in its regulatory programs. Animal biologics, such as vaccines, are regulated under the Virus-Serum-Toxin Act of 1913. All animal biologics are subject to the USDA regulations of 9 CFR Parts 101 to 118. Each vaccine must be licensed by the USDA and must meet regulatory criteria and undergo a risk assessment process to show any environmental hazards associated with its use (Gay and Orr, 1994).

Vaccines are suspensions of bacteria or viruses that may be live-attenuated (weakened), killed or otherwise modified, or antigens from microorganisms. When injected into an animal, vaccines provide protection (immune response) for that animal against the disease-causing microorganism. This protection is derived from the inoculated animal's ability to produce antibodies against the disease-causing micro-organism or antigen in a vaccine. In most emergency animal disease outbreaks, vaccination would be considered only as a last resort after other means of disease control have failed. The purpose of a vaccination program is to prevent the spread of a contagious animal disease from infected animals to uninfected livestock, wildlife, or humans.

There are only two animal disease programs in which VS routinely uses vaccines. These are the Brucellosis Eradication Program (Brucellosis Program) and the Pseudorabies Program. However, FMD vaccine

antigens are maintained for use in the event of an outbreak in North America.

2. Brucellosis Program

The Brucellosis Program is a Federal-State-industry cooperative program. The term brucellosis is most commonly associated with the disease in cattle. However, this disease affects pigs, sheep, goats, horses, dogs, wood rats, and humans (see Table 21). The Federal government pays up to 60 percent of the program funding and the State pays the balance. The program goal in the United States is to eradicate brucellosis from swine by 1996 and from cattle by 1998.

Brucellosis is the term for a group of contagious animal diseases caused by *Brucella* spp. bacteria. Brucellosis in cattle is a contagious disease caused almost totally by the bacterium *Brucella abortus* (see Table 21). However, *B. suis* or *B. melitensis* can be causal agents. In cattle the disease is known as Bang's disease or contagious abortion. It is characterized by abortion in females and impaired fertility in both sexes. Although other species of *Brucella* cause disease in various animals, these diseases are not targeted in the Brucellosis Program.

In the Brucellosis Program, the live-attenuated vaccine, *Brucella abortus* or strain 19, is used. This wild-type strain bacterium survives no more than a few hours in the vaccinated animal, which is sufficient to cause an immune response. Brucellosis in swine is caused by *Brucella suis*. However, vaccination is unreliable for controlling this disease. Except for *B. abortus*, no vaccines are licensed in the United States against *Brucella* spp. at this time.

The Brucellosis Program seeks to achieve its stated goal of eradication in cattle and swine by several methods. These methods are: primary and secondary surveillance to detect and delineate the disease, complete herd testing in high disease incidence areas, tracing of reactor animals from slaughterhouses back to the farm, increased immunity by vaccination for cattle with *Brucella abortus*, rapid depopulation of infected herds to eliminate disease sources, and public and industry information sharing. The brucellosis vaccine is licensed under the requirements for live bacterial vaccines found in 9 CFR 113.1 through 113.65.

Table 21. Animals Infected by *Brucella* Species

Host	Principal Pathogenic *Brucella* spp. Isolated	Other Pathogenic *Brucella* spp. Isolated
Cattle*	*B. abortus*	*B. melitensis* *B. suis*
Pigs	*B. suis* *B. abortus*	*B. melitensis*
Sheep	*B. melitensis*	*B. abortus* *B. ovis*
Goats	*B. melitensis*	*B. abortus*
Horses	*B. abortus*	*B. suis*
Dogs	*B. canis*	*B. abortus* *B. melitensis* *B. suis*
Wood rats	*B. neotomae*	
Humans	*B. abortus* *B. melitensis* *B. suis*	*B. canis*

*Only strain of licensed *Brucella* that VS routinely uses in a vaccination program.

3. Pseudorabies Program

The Pseudorabies Program is another Federal-State-industry cooperative program that seeks to eradicate pseudorabies from the domestic swine population by 2000. The pseudorabies virus (Aujeszky's Disease) is a contagious herpesvirus of swine belonging to the family Herpesviridae, *Herpesvirus suis*. This sometimes fatal disease affects the central nervous system. Although the disease is associated with pigs, other animals such as cattle and sheep may be affected. The disease has been responsible for major economic losses to the Nation's swine industry. In swine the disease causes abortions, still births, anorexia, and illness. Death occurs in young pigs. Mortality rates may reach 100 percent in pigs under 2 weeks of age. Weaned piglets have a much lower mortality rate. The pig is the most important host of the pseudorabies virus and the most significant maintenance host. In other livestock, dogs, and cats, the pseudorabies virus infection is usually

fatal, but these animals are not as likely to serve as a source of further disease spread.

The methods by which the Pseudorabies Program seeks to meet its stated objective include: vaccination to prevent disease, identification of infected herds through monitoring and surveillance, restricting the movements of infected swine by establishing quarantines, elimination of pseudorabies virus from infected herds, prevention of infection of domestic herds from feral populations, and producer and industry education and information sharing. The regulatory requirements for licensing of the pseudorabies virus vaccine are in 9 CFR 113.1 through 113.55 and 113.318, for live virus vaccines.

4. Foot-and-Mouth Disease

Currently FMD is not found in the United States. The disease is an acute, highly contagious, viral disease of domestic and wild animals caused by seven types of the virus *Aphthovirus*. The disease primarily affects cattle, swine, sheep, and goats, but also other cloven-footed animals. The primary route of transmission is by aerosols. The virus may be spread great distances by wind currents. FMD has not existed in the United States since 1929 and in Canada and Mexico since the 1950s. Because of the increased efficiency and speed of today's commerce and the economic pressures to reduce trade barriers, the potential for FMD to eventually reenter the United States exists.

Some vaccines against exotic diseases can be used in emergency situations. A supply of FMD antigens is maintained at the USDA Foreign Animal Disease Diagnostic Laboratory, Plum Island, New York. If an FMD outbreak is detected in Canada, Mexico, or the United States, these antigens could be made into a vaccine. Because FMD is an economically serious animal disease, VS would become involved in an emergency program to eradicate the disease once detection in the United States is confirmed.

5. Wildlife

Wildlife, such as bovids, susceptible to *Brucella abortus* infection, could be present in an area where a disease outbreak occurs (Starr *et al.*, 1981 and Fraser, 1986). This is an unavoidable circumstance that would be magnified by allowing the disease to persist but would be lessened by a coordinated brucellosis vaccination program. The possibility that wildlife would comingle with vaccinated cattle may enhance the possibility of cross-infection. However, the potential for wildlife infection is small if the vaccine is used properly, as in a Brucellosis Program. The presence of naturally-infected wildlife also may present a logistical problem for the Brucellosis Eradication Program. Brucellosis-infected bison in the Yellowstone National Park area allow a natural reservoir of the disease to persist, which has the potential to infect domestic livestock (World Wildlife Fund, 1990).

The wild-type pseudorabies virus has been isolated from naturally-occurring infections in wildlife (Fraser, 1986). Animals, such as wolves, coyotes, foxes, raccoons, Norway rats, mice, skunks, opossums, and roe deer may be infected by the pseudorabies virus. Experimental infections have been accomplished in many other species of mammals and birds. The role that wild animals play in the distribution of pseudorabies virus is not firmly documented although it is believed that, except for wild rats, they do not act as long-term carriers of the virus. Natural infection of pseudorabies may occur by the consumption of carcasses, aborted fetuses, or placentas from infected swine. As in a Brucellosis Program, naturally-occurring wildlife are expected to be in an area where vaccinations for pseudorabies are carried out and a potential exists for the comingling of domestic and wild animals. Vaccinated swine would be less likely to serve as a source of the virus for wildlife than unvaccinated swine (Fraser, 1986).

If FMD were reintroduced into the United States and became established in a livestock population, many wild cloven-footed animals exposed to the disease would become infected (Starr *et al.*, 1981; Fraser, 1986; and Balows, 1991). Vaccinations of wild animal populations may be impossible in an FMD program because of logistics and a lack of technology to deliver the vaccine to the wild populations. Depopulation of the affected wildlife population would then be necessary.

6. Animal Welfare

The possible need to capture wild animals in a vaccination program could be an animal welfare issue. An example is wild bison populations in Yellowstone National Park that are naturally-infected with brucellosis (Starr *et al.*, 1981 and Fraser, 1986). These animals have the potential of spreading the disease into nearby cattle populations (Brock and Madigan, 1988 and Balows, 1991).

7. Human Health

The bacterium *Brucella abortus* causes a contagious disease in animals. This bacterium is an opportunistic human pathogen (Fraser, 1986 and Balows, 1991). Brucellosis in humans is characterized by intermittent or irregular fever of variable duration, headache, weakness, profuse sweating, chills, arthralgia, and generalized aching. Although remote, the potential exists for the transmission of the disease to humans from infected animals. Brucellosis is a serious human health issue (Fraser, 1986). In the United States the greatest number of reported cases occurred to workers in jobs dealing with animals or cultures of *B. abortus* (Balows, 1991). These workers are Brucellosis Program and cooperating personnel, personnel in slaughterhouses, farm workers or laboratory personnel. Transmission of *B. abortus* may occur by ingestion or contact of contaminated discharges, feed, water, milk, aborted fetal or other infected tissue, exposure to airborne material, or by accidental self-inoculation of vaccine. Because the vaccine is limited

to use by trained veterinarians, the potential for accidental self-inoculation is slight. Therefore, the public is not generally at risk from either infected or vaccinated animals.

Pseudorabies is widespread on farms, but very rarely are humans infected with the virus (Fraser, 1986). In the Pseudorabies Program only one unconfirmed case exists where a human was reportedly infected by pseudorabies. Therefore, transmission of the pseudorabies virus to the Pseudorabies Program or cooperator personnel working with infected swine is very unlikely, either by the live-attenuated vaccine or by contact with infected swine.

Humans who have been exposed to the FMD virus may transfer the virus to animals or other humans for up to 24 hours. While there are authentic cases of FMD in humans, it is not a public health problem (Fraser, 1986).

8. Mitigation

Three issues are identified as having the potential to be impacted by VS vaccination programs. These include wildlife, animal welfare, and human health.

Vaccination programs themselves are a way to mitigate impacts to wildlife species and domestic animals in a disease control program. Without the use of vaccinations it may become necessary to destroy wildlife and domestic animals to preclude the further spread of an animal disease. Although there exists some potential for adverse human health effects by self-inoculation in a VS vaccination program, vaccines used in a VS program are limited to use by trained veterinarians, and the potential for accidents is lessened.

F. Facilities

1. Introduction

Facilities operated by APHIS VS include laboratories, animal import centers, and border crossing stations. Each of these facilities is responsible for specific functions in the context of prevention, surveillance, control, and eradication of animal diseases and pests. The principle facility functions include diagnostic services, training, research, and animal quarantine, as well as provision of central locations to conduct other measures necessary to guard against the introduction of exotic animal disease.

2. Laboratory Facilities

The National Veterinary Services Laboratories (NVSL) provide an array of diagnostic procedures, including pathology, bacteriology, virology, serology, immunology, parasitology, toxicology, chemistry, and a monitoring program to assure the quality and safety of biologics offered

for sale to livestock and poultry interests. In addition, the laboratories have a role in testing animals and birds offered for importation for disease agents which are exotic to the United States.

a. National Animal Disease Laboratory

Located in Ames, Iowa, the National Animal Disease Laboratory consists of six individual laboratory facilities:

Pathobiology Laboratory. The Pathobiology Laboratory is the APHIS reference laboratory that conducts histopathological examinations for tuberculosis; scrapie; VVND; Venezuelan, eastern, and western encephalomyelitis; hog cholera (HC); and other animal diseases. It also is the APHIS reference center for the taxonomic identification of ticks, scabies mites, and screwworms and is the national reference center for veterinary analytical toxicology.

The laboratory conducts comprehensive differential diagnostic studies and field investigations of exotic and enzootic animal disease outbreaks; provides technical support to the Veterinary Biologics program to ensure the safety, efficacy, potency, and purity of veterinary biologics; and provides diagnostic consultation, on-site field trips, and VS-sponsored training courses for APHIS personnel, as well as domestic and international visitors.

Additionally, the Pathobiology Laboratory conducts tests to detect fraudulent blood samples, provides chemical analysis of veterinary vaccines and foreign food products, performs quantitative analyses of insecticides and disinfectants, and monitors APHIS employee cholinesterase levels as part of the APHIS Safety and Health Program.

Diagnostic Bacteriology Laboratory. The causative agents of brucellosis, tuberculosis, and paratuberculosis are isolated and characterized in this laboratory in support of disease control activities. Environmental samples (swabs, feces) from poultry houses and poultry tissue are examined for the presence of *Salmonella* spp. Isolates are sero-typed, phage-typed, and subjected to plasmid analysis in support of the *Salmonella enteritidis* control program. Samples are examined for selected bacterial pathogens in support of the National Animal Health Monitoring System (NAHMS) surveys.

The Laboratory performs serologic tests for the exotic diseases, dourine and glanders, and for babesiosis of horses and cattle to qualify animals for importation and exportation. Tests also are performed for anaplasmosis, leptospirosis, paratuberculosis, salmonellosis, brucellosis, and contagious equine metritis. Serum banks for brucellosis and

tuberculosis are maintained for use in developing improved diagnostic tests.

Additionally, diagnostic reagents are produced for use in domestic and foreign laboratories. Training is made available to individuals from other laboratories and foreign countries through APHIS-sponsored courses and individual bench training.

Diagnostic Virology Laboratory. The laboratory's activities include isolation and identification of viruses, detection and measurement of serum antibodies elicited by viral infections, and production of reagents for use in domestic and foreign laboratories.

This laboratory works with viruses that cause serious diseases in animals and birds. These include HC, VVND, vesicular stomatitis, and highly pathogenic avian influenza (HPAI). As such, this is a high-security laboratory. Security is maintained by autoclaving or fumigating materials leaving the laboratory and by 100 percent air-exhaust through high-efficiency biological filters. In addition, a complete clothing change and shower are required for laboratory personnel and visitors prior to leaving the facility.

Biologics Virology Laboratory. The laboratory conducts assays on veterinary biological products used in the diagnosis, prevention, and treatment of animal diseases caused by viruses. Primary activities include confirmatory assays on new products prior to licensure; reference and reagent production, evaluation, and distribution; developmental activities; and quality control monitoring of licensed products.

Pre-license testing of new products at the laboratory includes the testing and certification of cell lines to be used in the production of new viral vaccines, diagnostic antigens, and monoclonal antibodies for diagnostic and therapeutic use. The "Master Seed Virus" for new viral products is extensively tested for purity and identity, and the initial series of new products are evaluated with the same tests that would be used later for randomly selected serials of licensed products.

The laboratory's developmental studies are directed toward developing *in vitro* antigen quantitation assays that reduce the number of animals needed for the evaluation of biological products. Additionally, rapid advances in biotechnological techniques and their incorporation into vaccine and diagnostic test development require a continuous re-examination, standardization, and expansion in the assay techniques used for quality assurance testing of new biotechnology products.

Randomly selected production serials of all licensed veterinary biologics are submitted to NVSL by the manufacturer. Monitoring of manufacturers quality assurance programs through the testing of randomly selected serials assures that only safe, pure, potent, and effective biologics are released for marketing. This effort also further reduces the need for test animals.

Biologics Bacteriology Laboratory. The Biologics Bacteriology Laboratory tests veterinary biological products that are used in the diagnosis, prevention, and treatment of animal diseases caused by bacteria and certain other nonviral agents. These tests ensure that the products are pure, safe, potent, and effective. Products tested include vaccines, antiserums, bacterins, toxoids, antitoxins, and diagnostic test kits.

The laboratory produces, evaluates, and distributes the reagents and reference preparations used by the biologics industry to perform the numerous tests needed to ensure the quality of biological products. The laboratory also provides assistance to Federal, State, university, and foreign laboratories in the evaluation of biologics and provides training for individuals from other laboratories and foreign countries through courses and practical laboratory training.

The laboratory also develops test methods for new veterinary biologics and continually works to improve current test methods. Major emphasis is placed on the development of *in vitro* test systems designed to replace animal tests.

Scientific Services Laboratory. The Scientific Services Laboratory provides scientific and technical support to animal health programs, the biologics industry, and the biologics and diagnostic activities of the NVSL. The laboratory provides the animal resources and services, computer services, media and chemical solutions, glassware, and metalware. Technical expertise is provided on sampling procedures, experimental and survey designs, and the interpretation and validation of statistical results.

The laboratory is responsible for the shipping and receiving of diagnostic specimens, biologics samples, reagents, and supplies for use in the NVSL, Federal, State, university, and foreign laboratories and animal health programs.

b. Plum Island Foreign Animal Disease Diagnostic Laboratory

The Foreign Animal Disease Diagnostic Laboratory (FADDL), located at Plum Island, New York, is a high level biocontainment laboratory with the expertise to confirm and diagnose approximately 40 animal diseases

foreign to the United States. It is designated as a reference laboratory for 11 diseases because of special staff expertise.

The Agricultural Research Service (ARS) functions as the lead agency at the facility and also maintains foreign animal disease research on Plum Island.

The Diagnostic Services and Scientific Services sections provide APHIS VS and many foreign countries with confirmation of an exotic animal disease diagnosis. Diagnostic Services also tests cell lines, hybridomas, viruses, vaccines, and specimens from animals to be imported into the United States for freedom of animal disease agents foreign to the United States.

The Reagent and Vaccine Services section develops diagnostic procedures, prepares reagents, develops and tests vaccine seed lots for exotic diseases, and maintains a foreign animal disease agent repository. As the custodian of the North American FMD antigen bank, this section monitors the antigen for purity, potency, and innocuity as required.

The facility has a Cobalt 60 gamma irradiation source for treatment of certain biological specimens being imported into the United States.

c. Veterinary Diagnostics Program

The objective of the VS Veterinary Diagnostics Program is to develop and implement a national and international program of laboratory support for the APHIS animal disease control and eradication programs and provide assistance to State and other Federal agencies and laboratories, educational institutions, and foreign governments in the diagnosis of animal diseases. To meet program objectives, VS conducts the following activities:

Diagnoses exotic animal and poultry diseases in samples submitted to the NVSL and Plum Island,

Performs surveillance and import testing to prevent the entry and spread of exotic animal and poultry diseases,

Produces and evaluates diagnostic reagents for use in domestic and foreign laboratories,

Provides technical support to the livestock industry to assist in controlling domestic diseases of economic importance,

Improves assays used for diagnostic testing through developmental studies,

Assists NAHMS in monitoring of livestock and poultry populations,

Tests imported products and scientific materials for safety,

Acts as custodian of the joint Mexico-Canada-United States-North American FMD vaccine bank,

Conducts training programs on the recognition of foreign animal diseases,

Provides training for individuals from the United States and foreign countries, and

Provides analytical support services to State and university diagnostic laboratories.

3. Animal Import Centers

There are four animal import centers responsible for the quarantine of imported animals. While at these centers, animals undergo observation, testing, and treatment (if required) to prevent the entry of foreign animal diseases and pests. Those animals that are free of disease are released to the importer. The animal import centers are: Harry S Truman Animal Import Center, Fleming Key, Florida; New York Animal Import Center, Newburgh, New York; Hawaii Animal Import Center, Kaneohe, Hawaii; and the Miami Animal Import/Export Center, Miami, Florida.

All ruminants from countries where FMD and rinderpest are known to exist are required to enter the United States via the Harry S Truman Animal Import Center. This is considered to be a maximum security facility. Birds other than ratites may be quarantined at the animal import centers or privately-owned bird import quarantine stations. These private facilities are operated in accordance with VS requirements, and VS personnel are present whenever the facilities are being used. Other than ostriches, ratites must be quarantined at the New York, Miami, or Hawaii Animal Import Center.

4. Border Crossing Stations

Border crossing stations are located on the U.S. borders with Canada and Mexico. At these locations, animals being moved across borders undergo testing and inspection to ensure all documentation is accurate and complete and that they meet any other necessary requirements. At the U.S./Mexican border crossing stations, cattle dip treatments are conducted to prevent the introduction of fever ticks, the vector for cattle tick fever, into the United States.

5. Facility Construction

Should a new laboratory, animal import center, or border crossing facility be required for VS activities, an analysis of possible environmental effects would be conducted. It would encompass all aspects of the facility that have potential environmental effects. These include, but are not limited to, human health, water and air quality, animal welfare, and medical and solid wastes.

Additionally, should an existing facility need to be modified such that the biosecurity is increased, which could decrease the risk of the introduction or spread of an animal disease or pest, an environmental analysis would be conducted to assess the potential environmental effects.

6. Environmen–tal Impacts Associated With Operation of Facilities

The laboratories and import centers operated by VS are involved with the handling of potentially hazardous biological materials. These pathogens, toxins, and other materials can cause disease in humans and other animals, and their release from any facility could have deleterious impacts on humans, domestic animals, wildlife, and other environmental resources, such as water. Pathogens, however, are not the only entities with the potential for causing environmental impacts. Human and animal wastes, medical wastes (*i.e.*, contaminated equipment and solutions, animal carcasses), hazardous chemicals (*i.e.*, reagents, solvents, disinfectants, pesticides), radiation (*i.e.*, ionizing, microwave, ultraviolet), stored gases (*i.e.*, oxygen, nitrogen, carbon dioxide), and noxious fumes (*i.e.*, from chemical reactions or products of incineration) may each be present in a VS facility. The disposition of routine solid wastes (paper, plastics, wood) and liquids (runoff, human and animal sewage) from VS facilities also can have an environmental impact.

Executive Order 12088, Federal Compliance With Pollution Control Standards, requires Federal facilities to take all necessary actions to prevent, control, and abate environmental pollution. VS compliance with this Executive Order is monitored through annual reports submitted to the Director, Office of Management and Budget, through the Administrator, USEPA.

7. Mitigation

The following resources/issues have been identified as being potentially impacted because of the operation of VS facilities—water, air, human health, animal welfare, and disposal of solid wastes. This section discusses those actions and measures taken to mitigate these effects.

a. Water

Protection of water resources is afforded through the use of typical wastewater treatment technologies such as sedimentation,

coagulation/flocculation, multi-media filtration, and chlorination. Some facilities are equipped with on-site water treatment capability, such as heat treatment for pathogen destruction purposes. In some cases, wastewater that is not used in contact with pathogenic organisms is transported directly into the local municipal wastewater treatment plant. Sludge produced from on-site treatment facilities, once determined to be pathogen free, is removed to the local municipal waste treatment facilities.

In those facilities where underground storage tanks (USTs) are in place, they are either in the process of being removed or are being replaced with fiberglass tanks. Those facilities where USTs will continue to be used are required to install leak detection devices. Under a USEPA mandate, UST corrosion protection devices that prevent spills and overflows will be required by December 1998.

b. Air

The use of incinerators has the potential to impact air resources. Those facilities that have incineration capability use equipment that currently meets all air emission standards. Older incineration equipment that is unable to operate within acceptable thresholds is not in use and is either being upgraded or replaced.

Recycling/recovery systems are in place where chloroflourocarbon refrigerants are in use.

c. Human Health

All testing and use of chemicals, including pesticides, disinfectants, and drugs, is conducted by trained professionals, thus minimizing any potential impacts on human health. The use and disposal of pesticides and disinfectants is in accordance with label instructions.

Biosecurity at those facilities that handle highly pathogenic agents and zoonotic pathogens is conducted according to Center for Disease Control guidelines. Work with those agents requires a high degree of biosecurity. The work takes place in tight confinement laboratories or animal holding units that have air infiltration systems. Also, laboratory personnel are required to change clothes and shower before and after entrance into these biosecure areas.

d. Animal Welfare

Animals that are housed at VS facilities are cared for by professional animal caretakers, animal health technicians, and veterinarians. Space and subsistence requirements specified by Federal statute are adhered

to. Should any animals need to be destroyed, humane methods of euthanasia are used.

e. Medical and Solid Wastes

The treatment and disposal of any medical wastes varies with each facility; however, incineration is the method most commonly used. Ash residues are disposed of in accordance with local solid waste disposal ordinances. Most facilities have arranged for licensed haulers to transport materials, such as spent pesticide containers, to permitted disposal facilities.

Solid animal wastes may be incinerated. They also may be pasteurized to eliminate pathogens and transported to the local wastewater treatment facility.

C. Animal Identification

1. Purpose

Effective and economical means of animal identification allows officials to quickly determine owners of livestock found to have a certain disease at slaughter facilities or other concentration points. The APHIS VS animal identification program is a Federal-State cooperative regulatory, prevention, and control program designed to monitor and safeguard the health of the Nation's livestock through the prevention of spread of communicable diseases. Animal identification has been historically practiced in the United States and did not originate as a VS program. With good records and permanent means of animal identification, operators on farm premises can immediately take appropriate action, such as imposing quarantines when diseased animals are discovered between the farm and slaughter.

The reason for providing a permanent means of identifying animals is twofold: (1) to identify those animals that are positive reactors to a specific disease and (2) to identify the premises of origin of suspect, exposed, or infected animals for use in trace-back as part of epidemiological studies during disease outbreaks.

2. Current Disease Programs Requiring Animal Identification

a. Brucellosis

Brucellosis infected cattle and bison are normally identified as reactors by hip branding. Animals also are ear tagged. However, those animals in herds that are scheduled for depopulation need only be identified by USDA approved backtags and accompanied either directly to slaughter by an APHIS or State representative or moved directly to slaughter in vehicles closed with official seals.

Swine that have met the criteria for being classified as infected are individually identified by ear tagging. This identifies the animal as a "U.S. Reactor" with an approved metal ear tag bearing a serial number. For those swine going directly to slaughter after being classified as infected, backtags may be used.

b. Livestock Tuberculosis

The eradication program for bovine tuberculosis (TB) in livestock provides for testing of cattle and bison for TB and also regulates cattle and bison movement. Reactor cattle and bison are identified by hip branding along with metal eartags which identify the animal as a "U.S. Reactor." Approved State reactor tags also may be used.

Exposed cattle and bison are identified using hip brands and by ear tagging with an approved metal eartag bearing a serial number. In lieu of branding, animals may be accompanied to slaughter by an APHIS or State representative or be shipped to slaughter in vehicles closed with official seals.

c. Other

There are other animal identification requirements for other disease programs in which APHIS VS is involved. These include FMD, pleuropneumonia, rinderpest, sheep scrapie, and equine infectious anemia. There are cases where non-diseased animals are identified, such as feeder and breeder animals that are in commerce, including export. Other instances of identification could be those animals identified by herd or country of origin.

d. Special Considerations for Swine Herds

All swine involved in commerce require an official means of identification. As in other identification programs, this effort is intended to facilitate trace-back of diseased animals to the farm of origin.

e. Alternative Methods of Animal Identification

Current APHIS regulations require or allow animals to be hot-iron branded on the hip as part of the Brucellosis and the Bovine TB Eradication Programs. The hot-iron brand also is used in the identification of those steers transported across the U.S.-Mexican border. Hot iron branding is widely used by the beef cattle industry to establish ownership. Brands are registered at the State and county level.

Various methods of marking or otherwise identifying diseased animals are either being used or are under investigation as alternatives.

Possible alternatives to hot-iron branding include freeze-branding, electronic identification devices, and other implantable devices. The possibility of incorporating bar codes on backtags to allow the electronic input of backtag numbers into the Brucellosis Information System has been investigated. Backtags are applied to the backs of animals and secured with an adhesive. They are a short-term means of identification for those animals going to slaughter.

In the cases of bovine TB and brucellosis, the hot-iron hip brand is currently considered the only acceptable means of identification that provides the immediate permanent identification necessary to help keep infected animals from providing a source for further spread of disease.

f. Information Technology and Epidemiology

There is dairy and sheep industry experience with electronic identification methods, including the use of neck mounted electronic identification devices and bar coded tail-tags. Other developmental uses are in effect for horses, ostriches, and pet animals. There is Canadian experience with the experimental use of an electronic identification system with slaughter cattle. As information technology matures, applications to more effective and efficient means of animal identification will continue to be explored.

g. Identification Tags

Tags used to identify animals for slaughter are accumulated in large numbers at the slaughtering facility. The disposal of these used tags requires compliance with State/local solid waste management policies.

3. Mitigation

Because the identification (trace-back) of diseases is essential to accomplishing the mission of prevention, surveillance, control, and eradication, animal identification is an unavoidable action. In those cases where it is considered practical to do so, alternatives to hot-iron branding are used.

H. Endangered Species

The interagency cooperation regulations, section 7 of the Endangered Species Act (16 U.S.C. 1531 *et seq*.), require all Federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of an endangered or threatened species or result in the destruction or adverse modification of critical habitat. The process by which agencies comply with this requirement is through consultation with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS). The species and habitats that may be affected by the VS programs and activities will determine whether the USFWS and/or the NMFS will be consulted. In

general, the NMFS has jurisdiction over marine species and the FWS over the remainder.

VS will initiate the consultation process with the FWS and the NMFS, if necessary, on a programmatic basis with the publication of this draft programmatic EIS. Additionally, consultation will be conducted for site-specific actions when VS determines the action "may affect" an endangered or threatened species or its habitat.

For a summary of environmental impacts see Table 22.

Table 22. Summary of Environmental Impacts

	Carcass Disposal	Chem-icals	Import/ Export	Vacci-nation	Facili-ties	Animal Identi-fication
Water	X	X			X	
Air	X	X			X	
Human Health	X	X	X	X	X	
Wildlife	X	X	X	X		
Animal Welfare	X		X	X	X	X
Solid Waste	X	X			X	
Indemnity	X					
Vegetation	X	X	X			
Cultural and Historical	X	X				
Utilities	X					

X denotes possible environmental impacts.
"Blank" is not applicable.

V. Long-Term vs. Short-Term Effects

The environmental effects of programs to control animal diseases need to be considered from the perspectives of both long and short-term effects. Activities identified in this document which have the potential to affect the human environment include carcass disposal, pesticides and disinfectants, import-export, vaccination, facilities, and animal identification.

Any environmental impacts resulting from properly conducted carcass disposal, regardless of the method used, can be considered short term in duration for two reasons. First, disease eradication campaigns requiring the destruction and disposal of large numbers of animals are infrequent occurrences. Therefore, the potential for cumulative effects leading to long-term impacts can be considered negligible. Secondly, disposed carcasses are, at the worst, only temporary pollution sources. Properly conducted disposal operations either destroy the pathogen outright or isolate it with minimal or no pollution. Those animal components that produce potentially harmful by-products decompose relatively rapidly (McDaniel, 1991).

Pesticides and disinfectants have the potential to produce long-term damage to the environment if not used and disposed of in accordance with label instructions and other local, State, and Federal statutes. However, damage to the environment from short-term use of pesticides and disinfectants during emergency disease eradication campaigns is not expected because of their limited and infrequent use.

Resources potentially affected by the Import-Export Program include human health, wildlife, and animal welfare. Since the import-export program is itself a mitigation program, its proper implementation will ensure that impact to any of these resources will be isolated and of short duration. Any long-term effects most likely would result from an overall failure of the program.

Resources potentially impacted by vaccination programs include wildlife, human health, and animal welfare. Any impacts to these resources due to vaccination can be expected to be short term. It is unreasonable to expect that a properly tested and administered vaccine can pose any long-term environmental impact.

Facilities' operation has the potential to affect water, air, human health, as well as to pose a solid hazardous waste generation and disposal problem. The facilities identified in this document operate within environmental management plans that are designed to limit discharges to acceptable levels. Any discharges from facilities would likely be an

isolated incident and as such would result in a short-term impact. Long-term effects would not be likely to occur.

Because animal identification (trace-back) of diseases is essential to accomplishing the mission of prevention, surveillance, control, and eradication, animal identification is an unavoidable action. In those cases where it is considered practical to do so, alternatives to hot-iron branding are used. Animal identification is not expected to have any long or short-term environmental effects.

VI. Irreversible and Irretrievable Commitment of Resources

Irreversible commitments are those that cannot be reversed, except perhaps in the extreme long term. Irretrievable commitments are those that are lost for a period of time.

This environmental impact statement (EIS) is programmatic in nature and reviews Veterinary Service (VS) programs and activities designed to prevent, control, and eradicate both endemic and foreign animal diseases and pests that may threaten domestic livestock and poultry, as well as wildlife resources. There are no resources that will be irreversibly or irretrievably committed because of ongoing VS programs and activities.

Allocations of budgets and personnel are short-term in duration. Future site-specific environmental assessments, which will be tiered to this programmatic EIS, will address in more detail any environmental consequences or commitment of resources for specific VS programs or activities. However, it is anticipated that the more site-specific environmental consequences associated with various programs and activities also will be short term rather than long term.

Only if there were no longer an effective VS program to prevent, control, and eradicate diseases and pests would there be a possibility of an irreversible or irretrievable threat to the resources. This would occur because of the possible long-term consequences to the resources if a disease or pest were to be uncontrolled and have widespread and long-term negative impacts to animal populations.

VII. Acronyms and Glossary

Abiotic	Pertaining to non-living things.
Acaricide	A pesticide used to kill mites.
Acute	Referring to a disease or disorder of rapid onset, short duration, and pronounced symptoms.
Adenovirus	A family of viruses usually found in respiratory tracts of animals and associated with respiratory disease.
Aerobic	Characterized by, or occurring in, the presence of oxygen.
African horse fever	A high mortality viral disease of horses transmitted by insect vectors, especially gnats.
African swine fever	A highly contagious, usually fatal, viral disease of swine that resembles hog cholera. The virus does not fit in present viral groups.
Allergen	Any antigen that produces an allergenic state in animals or humans.
Anaerobic	Absence of oxygen.
Anthrax	An infectious disease of cattle and sheep caused by the bacterium *Bacillus anthracis* that is communicable from animals to humans.
Antibodies	A class of substances induced by an antigen that can interact with specific or closely related antigens.
Antigen	Any substance that causes the body to produce antibodies to counter this substance. A substance that interacts with lymphocytes or antibodies or stimulates an immune response.
Antigenically	Based on antigen(s).
APHIS	Animal and Plant Health Inspection Service.
ARS	Agricultural Research Service.
Arthralgia	Joint pain.

Attenuated vaccine	Live bacterial or viral vaccine in which the organisms have been selected or modified in such a way as to greatly reduce their ability to cause disease but still retain their ability to evoke protective immunity.
Babesiosis	A group of animal diseases caused by protozoa in the genus *Babesia*, and transmitted by ticks.
Bacteriocidal	A substance that kills bacteria.
BAI	Bureau of Animal Industry.
Biologics	Any biological product produced and administered to animals, such as vaccines.
Biosecurity	Refers to the containment of diseased animal bodies, body fluids, or parts to prevent release into the environment until proper disposal is completed.
Biotic	Relating to life.
Blackleg	An acute, febrile disease of cattle and sheep caused by the bacterium *Clostridium chauvoei*.
Bovids	A group of ruminants that have non-deciduous horns, such as true antelope, oxen, cattle, sheep, and goats.
Bovine spongiform encephalop-athy	A chronic, progressive, fatal infection of the central nervous system caused by unconventional viruses with unusual characteristics. Also known as mad cow disease.
Brucellosis	Diseases caused by infection with the bacterial species of the genus *Brucella*. Also known as undulant fever in humans.
BSE	Bovine spongiform encephalopathy.
Cervids	A group of ruminants that have solid deciduous antlers; includes deer, elk, and moose.
CFR	Code of Federal Regulations.
Cholinesterase	An enzyme necessary for proper nerve function that prevents the accumulation of acetylcholine at nerve endings.
Cloven-footed	Referring to feet of oxen or sheep that are divided or cleft into two or more parts.

Communicable disease	An infectious agent that can be transmitted from one individual to another either directly by contact or indirectly by vectors.
Contagious	An infectious disease communicable by contact with an infected animal, its bodily discharges, or objects touched by it.
Depopulation	A program to achieve a great reduction in animal population with disease or contamination.
DHHS	Department of Health and Human Service.
Disinfectant	A chemical solution, heat, or other means used to kill or inhibit the growth of infectious microorganisms.
Dourine	A contagious venereal disease of horses caused by the parasite *Trypanosoma equiperdum*.
EA	Environmental assessment.
EC	Emulsifiable concentrate.
Ectoparasite	A parasite that lives on the exterior surface of its host.
Edema	An excessive accumulation of fluid in cells, tissue spaces, or body cavities (*i.e.*, bruise).
EIA	Equine infectious anemia.
EIS	Environmental impact statement.
Endemic	Restricted to a certain region or part of a region with diseases present in the population all the time but at relatively low levels.
Enterovirus	A group of animal viruses that are common worldwide and cause a variety of nervous system diseases.
Environmental fate	The final outcome of a compound released into the environment as it is changed by biological and non-biological components of that environment.
Enzootically	Pertaining to a disease that afflicts animals in a limited geographical area.
Epidemic	An extensive outbreak or period of unusually high disease incidence in a community or area.

Epizootic	A disease of animals that is widely prevalent and spreads rapidly.
Equine infectious anemia	An acute or chronic viral disease of horses; also known as swamp fever.
Equine metritis	A highly contagious bacterial venereal disease of horses.
ESA	Endangered Species Act.
Estuarine (estuary)	Any semi-enclosed coastal body of water, open to the sea, having a high freshwater drainage and marked cyclical fluctuations in salinity.
Euthanasia	Painless death.
Exotic Newcastle disease	An acute highly contagious fatal viral disease of fowl that attacks the internal organs. This viral disease is transmitted by the importation of infected exotic (pet) birds.
FAD	Foreign animal disease.
Febrile	Any disease associated or characterized by fever.
Feral	Wild. Having reverted from domestication back to the original wild or untamed state.
Fibrinogen	A soluble protein found in the blood that is part of the clotting process.
Fermentation	Slow but incomplete decomposition of organic substances by microorganisms in the absence of oxygen, such as alcohol fermentation.
FMD	Foot-and-mouth disease.
Fodder	Feed for livestock, usually coarsely chopped stalks and leaves of corn mixed with hay.
FONSI	Finding of no significant impact.
Foot-and-mouth disease	A highly contagious and acute viral disease affecting the mucous membranes of the nose, mouth, and skin near the hooves of cloven-hoofed animals. It may be transmitted to humans.
FSIS	Food Safety and Inspection Service.
GATT	General Agreement on Tariffs and Trade.

GIPSA	Grain Inspection Packers and Stockyards Administration.
Glanders	A contagious, usually fatal animal disease caused by the bacterium *Pseudomonas mallei* and characterized by development of nodules that occur most commonly in the upper respiratory tract. The disease usually is found in members of the horse family, but it can infect man and other animals as well.
Half-life	The time required for a given chemical reaction to affect one-half the amount of a compound present *(i.e.*, pesticide).
Histopatho-logical	Referring to tissue changes associated with disease.
Helminths	A large category of worm-like invertebrates.
Hog cholera	An epizootic infectious viral disease of swine that may be followed by a secondary bacterial infection from *Salmonella choleraesuis.*
Hydrogeology	The study of the geological aspects of water.
Immune response	Any response involving specific antibody production to an antigen.
Immunity	The condition where an animal resists or overcomes infection or disease by the production of antibodies.
Immunotoxic	A toxic effect on the immune system.
Indemnity	Warrants for damage, loss, or injury.
Infectious laryngo-tracheitis	An acute, highly contagious viral disease of chickens and pheasants.
Invertebrates	Any animal that does not contain a backbone (*i.e.*, ticks, mites, worms, crabs).
In vitro	In an artificial environment, such as a test tube.
In vivo	Inside a living organism.
Karst conditions	Pertaining to a thin layer of soil covering a layer of limestone, dolomite, or gypsum minerals that usually contain fissures or cracks allowing contaminated liquids to flow into subsurface water.

Lactic acid	An organic acid produced by the anaerobic metabolism of glucose. See fermentation.
Larvae	An immature and independent developmental life cycle stage of various animals, such as insects.
Leachate	A substance removed from the soil by percolating water.
Leaching	Dissolving out soluble parts from materials (*i.e.*, ashes, rocks) by running water through slowly.
Lymphocytes	A type of white blood cells found in the blood and lymph systems that are active in the immune response.
MCL	Maximum contaminant level.
Methemoglobin	The oxidized form of hemoglobin that is unable to reversibly carry oxygen in the blood.
Methemoglobinemia	The presence of methemoglobin in the blood.
Mucous membrane	A tissue found in the nose, throat, and digestive tract that contains glands that secrete mucus.
Mucus	A thick, slimy substance that is secreted by, moistens, and protects the mucous membranes.
NAFTA	North American Free Trade Agreement.
National Environmental Policy Act	NEPA procedures insure that environmental information is available to public officials and citizens before Federal decisions are made and actions are taken.
NDV	Newcastle disease virus.
Necrotic	Of or showing the death or decay of cells or body tissues.
NEPA	National Environmental Policy Act.
Nontarget organism	An organism that is not the objective of a pesticide treatment. See target organism.
NVSL	National Veterinary Services Laboratory.
Obligate	Restricted to a specific condition of life, as a parasite, that only can survive by living in close association with its host.

Off-gasing	The spontaneous release of a gas from a solid or liquid.
OIE	Office of International Epizootics.
Ornithosis	A virus disease that infects domestic fowl and other birds and is communicable to humans.
Parasite	An organism that lives during all or part of its life on or in another organism (host) at whose expense it obtains food or other survival benefits.
Parasiticide	An agent capable of destroying (killing) parasites.
Pathogen/ pathogenic	A disease-causing agent, usually refers to a living organism.
Perched water table	Groundwater that occurs above the true regional water table. Usually caused by the presence of impermeable rocks within otherwise permeable ones. Often especially sensitive to fluctuations in local precipitation levels.
pH	A measure of the acidity (<7) or alkalinity (>7) of a liquid in terms of the hydrogen ion concentration. On a scale of 1 to 14, the pH of water is 7 and considered neutral.
Pleuro-pneumonia	An infectious bacterial disease of cattle caused by *Mycoplasma* species and producing pleural and lung inflammation.
PPQ	Plant Protection and Quarantine.
Pseudorabies	A viral disease chiefly affecting cattle and swine (rarely man) transmitted by the wild brown rat.
Putrescible	Capable of decay or rot, especially by the action of bacteria and/or fungi.
Ratites	A flightless bird, as the ostrich or emu, having a flat breastbone without the keellike prominence characteristic of most flying birds.
Reactor animal	An animal that reacts positively to a foreign substance, as in a test for a disease.
READEO	Regional emergency animal disease eradication organizations.
Recharge areas	Areas in which water is absorbed that eventually reach the zone of saturation in one or more aquifiers.

Refilling	A process where soil is reapplied to the surface of a burial pit to absorb liquids produced by animal carcass decomposition, thus preventing these liquids from reaching the surface causing runoff contamination.
Rendering	A process using heat to extract fats, oils, and other products from slaughterhouse wastes and/or animal carcasses.
Rinderpest	A contagious, epidemic viral disease of cattle (and sometimes sheep and goats) in Africa and Asia.
Risk assessment	Any systematic document that examines the risks of doing or not doing a particular action or actions.
Ruminants	A group of mammals that regurgitate food that already has been swallowed and is further chewed before re-swallowing. See Bovids and Cervids.
Salmonella enteritidis	A bacterium that is associated with a wide variety of diseases in all animals, especially cattle, horses, and poultry.
Screwworm	The larvae of the blow fly, *Cochliomyia hominivorax*, that mature in surface wounds of animals. They are obligate parasites.
SCS	Soil Conservation Service.
Sentinel	Refers to any disease-free animal used to detect potential disease in other unknown disease-status animals.
Sera (serum)	Blood fluids with cells and fibrinogen removed.
Serologic tests	Tests dealing with the properties and reactions of blood sera.
Shipping fever	A severe respiratory disease of cattle associated with the bacterium *Pasteurella* spp.; also known as bovine pneumonic pasteurellosis.
Sp. or Spp.	Species (singular or plural).
Species	A group of individuals that may interbreed with each other but not with other such groups.
Swine erysipelas	An infectious disease manifest in a variety of forms affecting mainly growing swine and caused by the bacterium *Erysipelothrix rhusiopathiae*.

Swine vesicular disease	A transient viral disease of pigs with vesicular lesions on the mouth and feet. The disease is minor but must be differentiated from foot-and-mouth disease.
Synergism	An action where the total effect of two (or more) main ingredients is greater in combination than the sum of their individual effects.
Systemic treatments	A treatment that involves the whole body and not just one part or organ.
Target organism	An organism that is the objective of a pesticide treatment. See nontarget organism.
TB	Tuberculosis.
Terrestrial	Of or pertaining to the earth.
Teschen disease	An acute, infectious nervous disease of pigs caused by certain strains of pig enteroviruses; resembles polio in humans.
Texas fever	An infectious disease of cattle caused by the parasite *Babesia bigemina* that invades red blood cells. The vector is several species of ticks.
Thermophilic microorganisms	Bacteria or fungi that are capable of growth above 50°C (122°F).
Tiering	A NEPA term that refers to the process whereby the analysis of site-specific impacts of an action are included by reference in an EA without restating the analysis of general impacts that were contained in a broader document (such as an EIS).
Tissue	An aggregation of cells more or less functionally similar.
Toxic	Relating to a harmful effect of a poisonous substance from physical contact, ingestion, or inhalation.
Toxicity	The quality of being toxic.
Tuberculosis	A bacterial infection, especially of the lungs, by *Mycobacterium* spp. This disease affects man (*M. tuberculosis*), bovids (*M. bovis*), and other animals.
Turkey rhinotracheitis	An acute upper respiratory disease of young turkeys caused by the bacterium *Alcaligenes faecalis.*

Unabated (combustion)	Not diminished in force or intensity.
U.S.C.	United States Code.
USDA	United States Department of Agriculture.
USEPA	United States Environmental Protection Agency.
Vaccine	A suspension of live, attenuated, or killed bacteria or viruses or antigens that when injected into an animal, gives immunity against infection.
Vapor	The gaseous form of a liquid or solid.
Vapor pressure	The pressure exerted by a vapor when the vapor is in equilibrium (state of balance) with its liquid or solid form at any specific temperature.
Vector	An agent, such as an insect, that transmits a disease caused by a parasite, bacterium, fungus, or virus from one host to another.
Velogenic viscerotropic Newcastle disease	See exotic Newcastle disease.
Vesicular exanthema	An acute, highly infectious viral disease of swine characterized by fever and blisters on the snout and mucous membranes of the mouth and feet.
Volatilization	The changing of a liquid or solid to its gaseous or vapor state.
VS	Veterinary Services.
VVND	Velogenic viscerotropic Newcastle disease.
Wetlands	Areas that are flooded or drenched by surface or groundwater regularly and at appropriate intervals so that they are suitable to support vegetation requiring wet soil conditions (swamps, marshes, bogs, and similar areas). [Paraphrased, USEPA Pesticide Regulation (PR) Notice 93-3 March 9, 1993.]
WP	Wettable powder.

VIII. Preparation and Review

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It was also reviewed by the Office of General Counsel and numerous experts from the Animal and Plant Health Inspection Service.

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X. Appendices

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Appendix A. Issues Raised During Scoping

On July 23, 1992, the Animal and Plant Health Inspection Service (APHIS) published a notice of intent in the Federal Register to prepare a programmatic environmental impact statement (EIS) on the Veterinary Services (VS) program. On October 9, 1992, another Federal Register notice was published requesting written comments from the public, including Federal, State, and local agencies; environmental groups; industry; and other interested parties. The request was for the identification of the VS activities believed to have consequential impacts on the environment.

The scoping notice identified three activities with possible impacts on the environment that should be included in the analysis of the EIS: 1) the use of pesticides for disease vectors and reservoir control, 2) the use of disinfectants in the cleaning and disinfecting of premises where animals were raised or held prior to slaughter and the vehicle animals were transported in, and 3) the disposal of carcasses, along with the manure and debris associated with the diseased animals.

APHIS received 11 comments in response to the scoping notice from industry and wildlife/veterinarian groups, State clearinghouses, and private veterinarians. A summary of those issues follows.

Support of EIS

Commenters supported the development of the EIS stating that the three issues identified in the October 9, 1992, Federal Register needed to be addressed in an EIS in order to comply with the Federal, State, and local environmental statutes and regulations. They believed that identifying the environmental impacts of emergency disease control was critical so litigation would not delay such actions. Two commenters stated that both foreign animal diseases and those currently present in the United States should be included in the EIS.

Disinfectant/Pesticide Use

A commenter expressed the view that "old time" disinfectants be allowed for use even though they are not registered with the Environmental Protection Agency. Another commenter stated that the use of pesticides and disinfectants should be explored to ensure the protection of nontargets and their habitats.

Disposal of Carcasses

Two commenters stated that the disposal of the carcasses of diseased animals should involve a wide range of options from burial, open-air burning on tires, and "behind the hill" method. The commenters

believed that sunlight and exposure to the natural environment work as effectively as they have for millions of years prior to concerns about the environment. The commenter stated that APHIS should not overregulate the livestock industry with "what if" regulations.

One commenter provided information on the use of composting and fermentation as alternative methods of poultry carcass disposal. Composting has been proven to be environmentally safe and it effectively inactivates avian pathogenic microorganisms. The composted carcasses are useful as a crop fertilizer and soil amendment. Rendering of poultry carcasses into feed ingredients is valuable, but the spread of avian diseases while being transported is the concern. To overcome this, two demonstration units are using fermentation to inactivate the avian pathogen. This would allow the product to be safely transported to a rendering facility after fermentation.

A commenter stated that the EIS should include guidelines and discussions of the possible ways to dispose of carcasses, manure, and debris that will not affect wildlife or their habitats. Another stated that the EIS needed to include an analysis of the impacts of all carcass disposal methods.

Spread of Disease From Livestock and Poultry to Humans
One commenter was concerned about the spread of animal diseases to humans, particularly persons working at meat packing establishments.

Spread of Disease From Humans to Livestock and Poultry
One commenter was concerned about the spread of diseases from humans to livestock. It was stated that APHIS must take all the steps necessary, including the testing of people working in the livestock industry, to prevent the spread of tuberculosis from humans to livestock.

Control/Eradication Plan
One commenter was supportive of the efforts to develop plans for biologically safe and environmentally sound disposal of carcasses and manure before an emergency control/eradication program arises. The commenter requested that flexibility be incorporated into the plans to account for site-specific conditions and the varying regulations of the State and local regulations.

One commenter said that an effective domestic disease eradication program or emergency preparedness plans against foreign animal diseases depends upon swift, decisive, and effective actions of producers and regulatory authorities. The commenter agreed that the potential for environmental impacts should be taken into account as part of any

plan to control or eradicate any emergency disease outbreak. The commenter suggested a "team approach" be taken to develop action plans, and because of the differences in climate and soil types throughout the United States, the commenter recommended that the plans be developed as regional/local animal health plans. The commenter believed that the public should be aware of the need to use acceptable and approved methods to control/eradicate a disease that may affect public health safety, but that the control/eradication must remain the priority. It was stated that pre-planned, scientifically based strategies derived through consensus and implemented by a recognized authority (APHIS) is the best approach in assuring producer confidence and cooperation in combating the disease and/or disposal of condemned animals.

One commenter stated that livestock disease control and eradication programs should be conducted in ways that have no adverse environmental impacts. The commenter also suggested that the EIS should state that programs will be conducted in accordance with Federal, State, and local statutes, and should there be no such statutes, then decisions should be based on the best available science.

Vaccinations

One commenter stated that the approval process for genetically engineered vaccines must demonstrate that there are no adverse environmental impacts.

Spread of Diseases to Wildlife

Two commenters raised the issue of the affects of a foreign animal disease spreading to nontarget species, including endangered species. The impacts to these nontarget species, including their food sources, and their habitats, needs to be examined in the EIS. The commenters stated that the responsible Federal/State wildlife agencies should be identified and that they should be part of any communicable disease control/eradication effort.

They further stated that the control/eradication of a disease involving the destruction of wildlife should include a fiscal compensation system to the wildlife management agency with a provision for the reestablishment of wildlife populations and habitats adversely impacted by disease control operations.

One commenter raised the issue of the need for regulations for the control of diseases found in "game ranch" cervids and the possibility of disease control of Texas ranches where African antelopes are reared.

Appendix B. Milestones

December 18, 1865	First act of Congress to prevent introduction of disease in imported cattle by establishing quarantine stations Administered by the Treasury Department.
March 3, 1873	28–Hour Law approved providing that livestock in transit for more than 28 hours be fed and watered.
1883	Veterinary Division established in USDA to study animal diseases.
May 29, 1884	Bureau of Animal Industry (BAI) established by act of Congress. Formerly Veterinary Division of USDA.
August 25, 1884	Animal quarantine stations transferred from Treasury Department to USDA.
1887	Congress authorized BAI to purchase and destroy diseased animals.
August 30, 1890	Meat Inspection Act. Inspection of salted pork and bacon for export; quarantine of imported animals.
March 3, 1891	Meat Inspection Act amended. Included inspection of live animals for export and animals whose meat was intended for slaughter for interstate trade.
March 2, 1895	Meat Inspection At amended. Included disposal of condemned carcasses.
1899	BAI appropriations. Included monies for inspection of horses and horse meat.

June 30, 1906	Meat Inspection Act amended. Included sanitary inspections.
1906	Food and Drug Act. Established conditions of permitted use of veterinary drugs, feed use, curing, and preservative substances allowed in meats.
1906	28–Hour Law amended providing that animals in transport over 36 hours must be fed and watered.
March 4, 1913	Virus–Serum-Toxin Act. Provided for regulation of importation or interstate shipment of viruses, serum, and toxins for treatment of domestic livestock.
October 3, 1913	Underwood Tariff Act. Required imported meat to be inspected.
January 1, 1915	BAI Regulation 27. Required imported meat to be processed by an inspection system equivalent to that of the United States.
July 24, 1919	Horse Inspection Act. Required inspection of horses, horse meat and products, and labeling as such.
August 15, 1921	Packers and Stockyards Act. Established Packers and Stockyards Administration to regulate practices of meat packers engaged in interstate commerce and marketing of livestock through public stockyards.
July 1, 1927	Packers and Stockyards Administration transferred to BAI as Packers and Stockyards Division.

June 17, 1930	Smoot–Hawley Tariff Act. Prohibited importation of livestock from countries where foot-and-mouth disease or rinderpest is present. Required imported meat to be healthful, wholesome, and fit for human consumption.
June 29, 1935	Bankhead–Jones Act. Provided for the expansion of research in USDA.
1935	Packers and Stockyards Act amended. Included poultry.
June 28, 1938	Federal Food, Drug, and Cosmetic Act. Regulated the additives in meat.
1938	Agricultural Act. Provided for research on the utilization of animal and poultry products.
1938	Packers and Stockyards Act amended. Included auction markets.
September 21, 1944	Act establishing BAI amended. Authorized cooperation with States and their political subdivisions, farmers' associations and similar organizations, and individuals in the control and eradication of animal diseases.
August 14, 1946	Research and Marketing Act. Provided additional funds for research.
August 26, 1957	Poultry Products Inspection Act. Authorized compulsory inspection of poultry sold in interstate commerce.

1962	Talmadge–Aiken Act. Authorized USDA to enter into cooperative agreements with State departments of agriculture to administer and enforce Federal meat inspection laws.
August 24, 1966	Laboratory Animal Welfare Act. Required humane care of dogs, cats, nonhuman primates, and other animals used in research. Prevented petnapping.
December 15, 1967	Wholesome Meat Act. Amended Meat Inspection Act. Encouraged uniformity in the meat inspection system.
August 18, 1968	Wholesome Poultry Act. Extended authority of USDA for poultry inspections; Federal/State cooperation.
December 24, 1970	Animal Welfare Act. Amended Laboratory Animal Welfare Act. Authorized USDA to regulate other warmblooded animals when used in research, exhibition, or wholesale pet trade.
December 29, 1970	Egg Products Inspection Act.
April 22, 1976	Animal Welfare Act amended. Regulated commercial transport of animals.
April 27, 1976	Animal Welfare Act. Required humane air transport of certain animals.
October 10, 1978	Humane Methods of Slaughter Act. Amended the Meat Inspection Act. Required humane treatment and slaughter of livestock at slaughter establishments.

Appendix C. Examples of Disease Eradication Programs

The purpose and importance of APHIS VS foreign animal disease prevention, surveillance, control, and eradication programs can perhaps best be illustrated by a brief review of actual historic disease eradication campaigns. The synopsis of hog cholera eradication was adopted from *100 Years of Animal Health 1884-1984.* The exotic Newcastle disease eradication summary was adopted from Exotic Newcastle Disease Emergency Disease Guidelines developed by APHIS VS.

Hog Cholera

Hog cholera is a highly contagious, systemic, viral disease affecting only swine. The swine disease known as hog cholera first appeared in the United States in the Ohio Valley in the 1830s. It was recognized in 13 States by 1855 and eventually spread to 35 States from Maine to Texas to California by 1887. It soon spread throughout Europe and to most of the world in areas where significant numbers of pigs were produced. Losses because of hog cholera were enormous, and disposal of infected dead carcasses became a significant problem for farmers.

In the early 1900s live virus vaccines were developed by BAI personnel and proved effective in protecting swine herds against the disease. It was recognized at the time that although immunization was partially effective, any effort to eradicate hog cholera would take more time. The vaccination program was designed to mitigate against catastrophic loss to the industry, but continued outbreaks were not uncommon.

In 1950 plans to eradicate hog cholera were developed. The National Committee for Hog Cholera Eradication devised a nine point program which stated the following as goals:

1) Eliminate virulent hog cholera virus
2) Prohibit feeding of raw garbage to swine
3) Require reporting of known or suspected outbreaks
4) Quarantine infected premises
5) Control movements of swine
6) Clean and disinfect vehicles and infected premises
7) Increase vaccination against hog cholera
8) Intensify hog cholera research
9) Institute a long-range information and education program

This program commenced in 1961. Prior to the campaign, about 5,000 herds every year were diagnosed with hog cholera. Diagnosed herds dropped to 100 by 1971 and continued to decline until none were reported by 1977. The last isolated case was identified in 1976.

Beginning with an initial appropriation of $10,000, U.S. Department of Agriculture (USDA) veterinarians conducted research on hog cholera for 100 years, from 1878 until eradication in 1977. Since the virus still exists in Mexico and many other countries, hog cholera virus is maintained at the National Veterinary Services Laboratory and the Foreign Animal Disease Diagnostic Laboratory for diagnostic purposes. Should the virus get into the United States in live swine, swine products, or biologics, prompt detection and accurate diagnosis would be essential to avoid disease spread and subsequent damage.

Exotic Newcastle Disease

Exotic Newcastle disease or velogenic viscerotropic Newcastle disease (VVND) is a contagious and often fatal viral disease affecting wild, domestic, and caged birds. It is probably the most serious disease of chickens and turkeys throughout the world. This disease is characterized by edema and congestion of certain tissues in the respiratory and digestive system. A variety of nervous manifestations may be exhibited. Some gastrointestinal lesions may become necrotic. The infection can occur in humans usually as a mild to severe conjunctivitis lasting for several days.

The first case of VVND in the United States occurred in 1950 in partridges and pheasants imported from Hong Kong. The disease often occurred in imported pet birds but seldom spread to commercial poultry. When the disease did occur in poultry, it was controlled through vaccination. In November 1971 a major outbreak occurred in commercial flocks in southern California after a shipment of infected pet birds from Latin America and the Orient arrived in the poultry-rich San Bernardino Valley. Despite State and Federal efforts to contain the disease using quarantines and vaccination, it continued to spread, eventually threatening the entire U.S. poultry and egg supply. Smaller outbreaks also have occurred in Puerto Rico, Florida, and Arizona. In March 1972 the United States faced its largest animal health emergency in more than 40 years. A national health emergency was declared and a major eradication campaign began. During the next 2 years, 1,342 infected and exposed flocks were identified and nearly 12 million birds, mostly chickens for commercial egg production, were destroyed. The operation was conducted at a cost of $56 million to taxpayers, and it severely disrupted the operations of producers in the affected areas. More than 2 years later, in July 1974, the USDA and the State of

California had succeeded in eradicating VVND. The last isolated case of VVND from domestic poultry in the United States occurred in 1975. VVND still occurs enzootically in many countries today.

Appendix D.Foreign Animal Diseases

The following are examples of some of the most economically devastating animal diseases foreign to the United States.

African horsesickness

African swine fever

Bovine spongiform encephalopathy

Contagious bovine pleuropneumonia

Contagious equine metritis

Egg drop syndrome

Foot-and-mouth disease

Fowl plague

Glanders

Heartwater

Hog cholera

Lumpy skin disease

Rift Valley fever

Rinderpest

Screwworm myiasis

Swine vesicular disease

Velogenic viscerotropic Newcastle disease

Vesicular exanthema

Appendix E. Line Items

Veterinary Services activities relate directly to the authorization and funding. Authorization is usually considered long term or effective until modified by Congress; whereas, funding is viewed as short term or annual. Most of the funds are contained in the annual U.S. Department of Agriculture budget; however, a limited amount is collected from user fees. Often some line items are funded for more than one year. In most years new line items are dropped and new line items are added.

Animal identification

Biotechnology

Cattle ticks

Emergency programs

Import-export

Miscellaneous diseases

National poultry improvement plan

Poultry diseases

Salmonella enteritidis

Scrapie

Swine health

Tuberculosis

Veterinary biologics

Veterinary diagnostics

National Animal Health Monitoring System

Appendix F. Hog Cholera Emergency Disease Guidelines

[NOTE—These carcass disposal methods are taken from *Hog Cholera Emergency Disease Guidelines* prepared by the Animal and Plant Health Inspection Service, U.S. Department of Agriculture, Hyattsville, MD (revised June 1992).]

7.7 Disposal Methods of carcass disposal include burial, incineration, and rendering. Many factors must be considered and often other State or Federal agencies have to be consulted before a method of disposal is selected. The environmental and legal impacts of the operation must be considered. Upon recommendation of the State or Federal agencies, the Emergency Programs Staff (EPS), Veterinary Services (VS) Chief Staff Veterinarian may consider other disposal methods.

7.7.1 Burial Burial of carcasses, feed, manure and bedding on the affected premises is the preferred method of disposal. The site should be on the affected premises or as close to the premises as topography permits. Federal, State, and local environmental laws and regulations may impose requirements on this disposal method. The Regional Emergency Animal Disease Eradication Organization (READEO) Environmental Impact Officer is responsible for liaison with Federal, State, and local authorities to determine what requirements apply. They will arrange for the issuance of the necessary permits and clearances.

The following steps should be taken for this method of disposal:

1. The READEO Disposal Officer selects a burial site as soon as possible after confirmation of the diagnoses of hog cholera. If a suitable site is not available on the affected premises, then sites should be inaccessible to animals, removed from populated areas, should not be used for agricultural purposes, should be clearly marked, and properly protected. Locate sites enough distance from underground cables, water or gas lines, septic tanks, and water wells. Sites should

be away from public view, if possible. Get approval from the READEO Environmental Impact Officer before digging trenches for burial.

2. The READEO Disposal Officer provides the READEO Procurement and Supply Officer with: dimensions, depth, cubic yards of materials to be removed, and other special requirements for digging the trench and refilling it after burial. Trenches are normally 9 feet deep with dimensions of 7 x 2 feet (14 square feet of floor space) which is required for 5 mature pigs. If equipment and soil conditions permit, it may be desirable to dig deeper (12 to 20 feet) and wider trenches. For every additional 3 feet in depth, the number of animals per 14 square feet of floor space can be doubled. Depth and width of trenches may be varied with soil conditions, water table, and type of equipment available for digging.

3. Contaminated manure, bedding, and feed from stalls that housed affected animals can be buried with carcasses with a cover of at least 6 feet of soil. Do not tightly pack soil when refilling trenches because the decomposition and gas formation will crack a tightly packed trench causing it to bubble and leak fluids.

4. Guide hogs into trenches where euthanasia is performed. If euthanasia is performed outside the trenches, then transport the carcasses using a tractor with a front end loader and chains, a trailer, a truck, or other means of safe conveyance. If the burial site is away from the affected premises, transport the carcasses in leakproof enclosure trucks or trailers. If transporting live animals to the sites, then use biosecured leak-proof conveyances. Bury the animals as soon as possible after death.

5. The READEO Procurement and Supply Officer will work through the Contract Officer to secure needed equipment and services for the project.

7.7.2 Burning Burning of carcasses is difficult and expensive in labor and materials used. Burning should be used

only when burial is not feasible. A high water table, excessive rock conditions, public health or environmental protection reasons may prevent use of burial for disposal and allow the incineration instead. A holding pen for confining animals prior to depopulation should be available near the burn site. In some instances, farmyards and existing holding pens may be adapted for this purpose. In other cases, new pens may have to be constructed. Burning of few carcasses is feasible on the affected premises if fuel is easily obtainable. Permits and clearances to proceed must be obtained to avoid violating environmental laws. The READEO Environmental Impact Officer is the liaison with the Federal, State, and local environmental officials to determine what requirements apply. They will arrange for the issuance of permits and clearances for this method of disposal. (Burning is not legal—EPA)

The following steps should be taken for this method of disposal:

1. The READEO Disposal Officer will select sites for burning that are flat, open areas, and away from public views. They will be clear of buildings, hay or straw stacks, and overhead telephone or electric cables. Sites should be accessible to heavy transport vehicles. Be careful not to build the fire over shallow underground pipes or gas mains. Do not build fires downwind from houses, farm buildings, roads, or populated areas. Avoid building the fire over shallow underground water pipes or gas mains. The prevailing wind direction should be considered to prevent unnecessary quantities of smoke and objectionable odors from blowing down on farm buildings or across public roads.

2. The READEO Disposal Officer is responsible for identifying the required materials and equipment. The READEAO Procurement and Supply Officer is responsible to secure materials and equipment not available on the affected premises. Following are material and equipment requirements:

a. Straw or hay—3 bales per 5 adult swine carcasses.

b. Heavy timber—Use 3 pieces approximately 1 foot wide and 8 feet long for adult swine carcasses. Railroad ties or bridge timbers make ideal material. If smaller dimensions are used, proportionately more pieces will be needed.

c. Old tires—Allow 4 to 5 old tires per 5 adult swine carcasses.

d. Kindling wood—Allow 50 pounds per 4 to 5 adult swine carcasses. Some suggested sources include farm wood piles, wrecking companies, sawmill slab piles, etc.

e. Coal—This should be of good quality and in large lumps, 6 to 8 inches in diameter. Avoid fine and powdered coal. Allow 100 lbs. of coal per adult swine carcass. Proportionately less is required for young stock.

f. Liquid fuel—Waste oil, furnace oil, or diesel fuel should be obtained in sufficient quantity to completely soak the other materials before lighting. Use a minimum of 1 gallon per adult carcass. Keep a reserve quantity of liquid fuel on hand during the burning process in case encountering difficulty in burning or keeping the fire lit. **Do not use gasoline or other highly flammable fuels.**

g. A small bulldozer or tractor with a scoop should be available for tending and rearranging fires periodically.

3. When a site is selected, the READEO Environmental Impact Officer has the necessary permits or clearances, and the materials have been delivered, proceed with fire preparation. Construct fires at a right angle to the prevailing wind to improve burning (refer to the FMD Guidelines for details). The fire should be constructed as follows:

a. Make firebeds 7x3 feet for each five adult carcasses.

b. Place three bales of straw or hay lengthwise on the 3 feet width. Allow 3 feet run per five adult swine, and lay the rows approximately 12 inches apart between each bale in a row.

c. Place loose straw or hay in the openings between the bales.

d. Place large timbers on top of the bales on the 7 feet length with 6–12 inch preparation.

e. Distribute large and medium-sized timbers on top of the longer timbers.

f. Place old tires and kindling wood on the fire bed.

g. Spread any loose straw, hay, or bedding over the wood and tires.

h. Spread coal, if used over the wood and tires to make a level bed. A front end loader or a tractor is valuable to help spread the coal.

i. Place carcasses alternately (head-to-tail) with the feet in the air on the fire beds. This can be best done with a tractor with a front end loader and chain or other hoisting equipment which helps place carcasses on the fire beds.

j. Place loose straw or hay over the carcasses and stuff it in the openings between them. Recheck to assure there is no danger of fire spreading beyond the burn site.

4. Transport carcasses in leak-proof trucks or trailers when sites for burning are away from the affected premises.

5. Arrange to have fires guarded continuously until carcasses are destroyed to prevent predators from disseminating infected materials.

6. Ignite the fire when ready. Pour or spray liquid fuel (**Do not use gasoline)** over the pyre, using buckets, sprinkling cans, or a pump sprayer. Use a torch (that will burn for several minutes), for starting the fires. Lite them along the entire length of the pyre.

7. Periodically tend the fires by stirring the coals, replacing carcass pieces that drop off, and adding fuel as necessary. With a good steady wind and favorable weather conditions, carcasses burn in abut 48 hours.

8. Bury the remaining ashes when carcasses are completely burned and the fire has died out.

9. Clean-up, grade or plow, and prepare for seeding all the burn sites. (Note: burning is not legally approved, but this may be the best alternative in some situations—consult EPS).

7.7.3 Rendering The most economical method of disposing of carcasses is rendering. However, satisfactory rendering plants are not always available. The movement of carcasses to the rendering plant poses some additional risk of spreading the agent. This method of disposal requires approval by the Deputy Administrator, VS (see: 9 CFR, Part 53.4). The collection and transport of carcasses for rendering should be carried out in closed leak-proof vehicles that can be easily cleaned and disinfected. The vehicle should be built so that leakage and aerosol dispersal during transport is prevented. The handling of the carcasses should be kept to a minimum. Following are some guidelines for consideration:

1. During the euthanasia process and handling, avoid mutilating the carcasses to keep leakage to a minimum.

2. All trucks hauling carcasses to rendering plants should be leak-proof and covered.

3. All infected animals and carcasses should be under 24 hr/day security until the pathogens are destroyed. For example, an official should

accompany each truckload of carcasses to the renderer and someone should be on duty at the rendering plant while any viable pathogens are present. Cleaning and disinfecting equipment should be thoroughly cleaned and disinfected following exposure to infected carcasses.

4. The rendering plant should be inspected and approved for disposal of the infected and exposed carcasses before sending any carcasses to the plant.

5. The rendering plant should be reasonably accessible and have a larger capacity than considered normal for operating conditions to handle the number of carcasses that would be expected during emergency.

6. Be careful not to overload the rendering plant and damage the equipment.

7. The implementation of biosecurity measures to avoid recontamination of the product should be strictly and uniformly applied. Complete separation between clean and dirty areas must be maintained, and regulatory controls will need to be implemented to monitor the microbiological quality of the rendered product.

7.7.4 Other Selected Methods

Other selected methods of disposal may be recommended by the Area Veterinarian In-Charge (AVIC), VS, the State Animal Health official, or READEO Director that should be directed to the Deputy Administrator, VS, for approval (9 CFR, Part 53.4). An example of an alternative method of disposal would be the use of an incinerator such as at a State Veterinary Diagnostic Laboratory or a diagnostic laboratory at a College of Veterinary Medicine. Manure, feed, hay, and bedding may be composted as an alternative to burying and burning. This method should be done in an area that is not accessible to swine or other susceptible animals.